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1859 FIFTY-EIGHTH YEAR 1916

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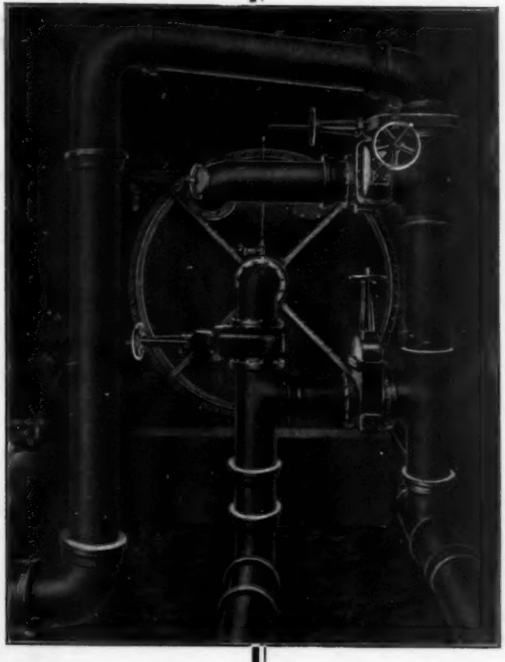
Adaptability—



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The most efficient method of carbonizing coal is in KOPPERS OVENS and the best coke and by-products are produced by this process.

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1859 FIFTY-EIGHTH YEAR 1916

AMERICAN

GAS LIGHT JOURNAL

VOL. CV., No 26 NEW YORK, DECEMBER 25, 1916 WHOLE No. 3,068

Finished Artificial Mantle as Furnished To-Day Represents More Labor, Investigation, Technical Skill and Refinement of Process than Any Other Substance Used in Manufacture of Lighting Apparatus

Fibre Obtained by Dissolving Cotton in Nitric and Sulphuric Acids—Small Irregularities in Shape and Finish of Mantle do not Lessen Its Illuminating Power Unless They be of Such a Nature as to Affect Its Performance in Burning

By ROBERT FFRENCH PIERCE

In the development of the Welsbach or incandescent gas mantle, one of the most important considerations has been the finding of a fabric that will "stay put" under the heat of the gas flame. In any type of light source it is desirable that the quantity of light emitted at all times during its life be the same. Any depreciation in candle-power during life necessitates the installation of just so much more capacity in order to compensate for future depreciation, and this added capacity is so much net loss.

In searching for a better fabric for mantle making, investigators early appreciated the fact that vegetable fibres, all of which were cellular and fibrous in form, offered little in the way of improvement. The ideal fibre would be one of a solid, non-cellular, continuous nature, bearing the same relation to vegetable fibres that a steel cable bears to a hempen hawser.

How Artificial Fibre is Obtained

Such a fibre was obtained by dissolving cotton in nitric and sulphuric acids, breaking down the cellular structure, the cellulose being precipitated out of the solution by ammonia as a syrupy mass, devoid of structure or form. By squirting this cellulose through a die, and hardening the tiny filament so produced, a continuous solid rod of pure cellulose is obtained, from which a mantle may be knitted and sewed, saturated with thorium and cerium salts, and the cellulose burned out precisely as with a cotton mantle.

Many processes for making this artificial fibre are available, but many produce a sort of fibre that is (for reasons which need not be stated here) unsuitable for mantle manufacture. After the fibre is obtained, the making into a satisfactory mantle involves many difficulties not met with in the manufacture of cotton mantles, so that the production of the fibre itself is really the least important part of the development.

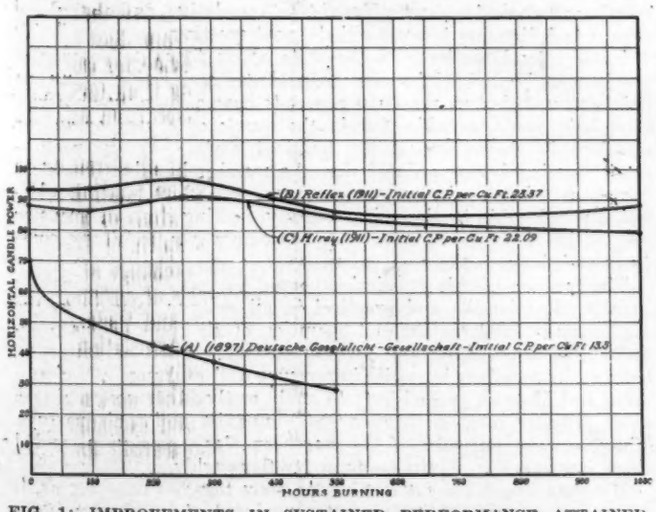

(B) Reflex (1911)–Initial C.P. per Cu.Ft. 25.37
(C) Hiray (1911)–Initial C.P. per Cu.Ft. 22.09
(A) (1897) Deutsche Gasglulicht-Gesellschaft–Initial C.P. per Cu.Ft. 13.5
HORIZONTAL CANDLE POWER
HOURS BURNING

FIG. 1: IMPROVEMENTS IN SUSTAINED PERFORMANCE ATTAINED DURING PAST 15 YEARS

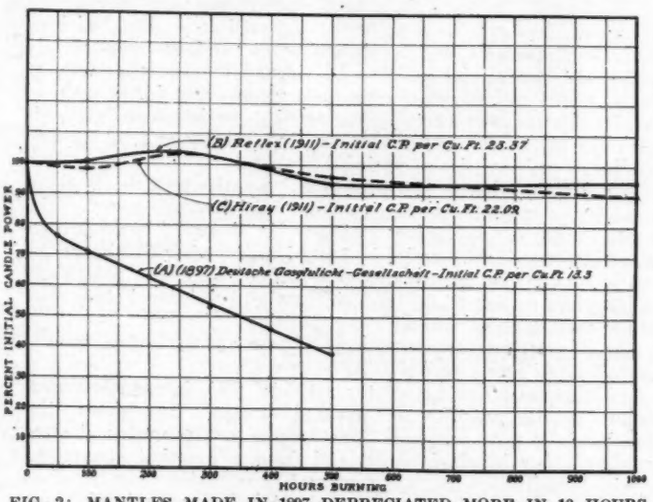

(B) Reflex (1911)–Initial C.P. per Cu.Ft. 25.37
(C) Hiray (1911)–Initial C.P. per Cu.Ft. 22.09
(A) (1897) Deutsche Gasglulicht-Gesellschaft–Initial C.P. per Cu.Ft. 13.3
PERCENT INITIAL CANDLE POWER
HOURS BURNING

FIG. 2: MANTLES MADE IN 1897 DEPRECIATED MORE IN 10 HOURS BURNING THAN MODERN MANTLES DO IN 1,000 HOURS

The finished artificial fibre mantle as furnished to-day represents more labor, investigation, technical skill and elaboration and refinement of manufacturing process than any other substance used in the manufacture of lighting apparatus. It is not too much to say that it has been many times more difficult than the development of the carbon and tungsten filament electric lamps put together, yet this fact is unknown to the general public and is perhaps only appreciated by those who have actually done the work.

Improvement in Strength and Efficiency of Gas Mantles

That recent years have witnessed a continuous and considerable improvement in the strength and efficiency of gas mantles is pretty generally understood. Every user whose experience extends over a decade must have noted the greater ruggedness and illuminating power of the product of the last four or five years. This appreciation is, however, usually rather vague and seldom based upon definite knowledge, and it is more than likely that the achievements of recent years are very much underestimated. This

is partly due to the considerable number of cheap mantles still being put upon the market, some of which show little improvement over the product of ten or fifteen years ago. On the other hand, modern developments have not been entirely confined to the most expensive grades.

While the price of a mantle is, broadly speaking, an indication of the cost of manufacture, many of the refinements incorporated in mantles of the highest grade may be omitted from the less expensive grades without materially detracting from their usefulness for many purposes.

For instance, mantles designed for maintenance work need not bear the evidences of extremely careful workmanship which are required to satisfy the critical inspection of the individual purchaser.

Small irregularities in shape and finish do not lessen the illuminating power of the mantle unless they be of such a nature as to affect the performance of the mantle in burning. Since maintenance mantles are subjected to more frequent handling than mantles installed by the consumer, and are therefore more often accidentally broken, it is important that a less expensive mantle be used, provided the decrease in price is not accomplished at a sacrifice of maintained candle-power.

Artificial Fibre Mantle Retains Strength Throughout Life

The improvements in sustained performance that have been attained during the past decade and a half are illustrated in Fig. 1. Curve A shows the performance of an upright mantle manufactured in 1897 by the *Deutsche Gasglulicht-Gesellschaft.** The gas consumption is not stated but other tests of similar date showed an initial duty of about 13 horizontal candle-power per cu. ft. of gas. Curves B and C represent, respectively, the performance of Reflex and Hiray mantles made in 1912, the initial duties being respectively 23.37 and 22.09 horizontal candle-power per cu. ft. of gas consumed. In 1897 the manufacture of gas mantles was well advanced. The extreme fragility of the earliest product had been fairly well overcome, and the incandescent gas lamp was a firmly established commercial article. In view of the fact that tests of ten or twelve years ago are even to-day sometimes drawn upon to substantiate claims concerning the rapid depreciation of gas lighting units the enormous progress both in efficiency and maintained candle-power is worthy of notice.

Fig. 2 shows the performance of the mantles referred to above as regards per cent depreciation from initial candle-power. The mantles made in 1897 depreciated more in 10 hours' burning than either of the modern mantles in 1,000 hours. After 500 hours the earlier mantle had depreciated over 60 per cent, was practically useless, while neither of the modern mantles deteriorated more than 10 per cent in one thousand hours' burning.

For all practical purposes the candle-power of the best mantles is *undiminished over a period of 5,000 hours.*

An immense advantage of the artificial fibre in mantle manufacture is the retention of physical strength throughout life. Mantles made upon vegetable fibres become greatly weakened after burning a few hundred hours, and from a practical standpoint this is a much more frequent source of depreciation than the diminishing candle-power. Most mantles based upon natural fibres go out of service from breakage due to lessened mechanical strength long before the candle-power has fallen to such a point as to render them useless.

Mantles made of artificial fibre, on the other hand, lose their mechanical strength very slowly, and after burning several hundred hours, the fibres are still sufficiently strong to support a weight of one ounce, whereas, natural fibre mantles after the same period can support little more than their own weight.

The introduction of the artificial fibre into mantle making has resulted in the elimination of one of the most serious handicaps under which gas lighting has labored in the past.

In this connection, it is worth noting that there is practically no "smashing point" for the better grades of gas mantles. Even in the extreme case of mantles costing 30 cents each, the useful life is in the neighborhood of 2,000 hours,* and breakage of the mantle from mechanical causes—shock, vibration, handling, etc.,—will in the majority of cases occur before the end of "useful life". The lower grades, however, depreciate so rapidly in candle-power that they should be replaced, regardless of their condition at the end of 100 or 200 hours. Unless conditions are such that the average life of mantles due to accidental breakage is considerably less than one or two hundred hours, the use of any but the higher grades is uneconomical.

*Deterioration of Gas Lighting Units in Service—R. F. Pierce, Trans. Illuminating Engineering Society, Oct., 1912.

Realization of Greatness and Promise of the Gas Industry Prompted Formation of Texas Gas Association

President M. T. Walker Explains Newest State Association's Aims and Outlines Work That Should Be Done—Advantages of Personal Acquaintance

For a long time some of us have felt there was a need of an organization in the State of Texas that would bring together the men in the state engaged in artificial and natural gas business for the discussion of subjects of mutual interest, stated M. T. Walker, manager of the Beaumont Gas Light Company and president of the Texas Gas Association, in his address at its recent annual meeting. We had hoped that this need would be met in some way by the Southwestern Gas and Electric Association, but year after year some of us have gone to these meetings to find only two or three gas men present with no program arranged for the instruction and benefit of the gas fraternity and no interest manifested by the gas men in the association work.

It has been charged that the gas men themselves were to blame for this in that they have not responded to invitations to participate in the proceedings of that association. If we are guilty, as charged, there must be some fundamental reason for it. I do not believe the gas men of this state will ever consent to sit in the anteroom of any association—especially one predominated by interests in direct competition to our business. We represent a great and growing industry. The Census Report for 1910 shows the growth of gas business in the United States from 1900 to 1910 to be as follows:

Increase in number of Establishments	47.8 per cent.
Increase in value of Products	120.3 per cent.
Increase in amount of Capital	61.4 per cent.
Increase in cost of Materials	154.4 per cent.
Increase in number of persons employed	80.0 per cent.
Increase in Wages and Salaries	88.1 per cent.

We are proud of this record of our work, and it stands out before the world as evidence of the brains and energy of the men engaged in the gas business. Therefore, is it any wonder we gas men in Texas should feel that we should control and direct our own association affairs?

Initial Steps Taken Earlier in Year

Last spring a number of the gas fraternity felt that some steps should be taken to interest the gas men of the state in the organization of a gas association. D. J. Storms, of Amarillo, took the initiative and addressed communications to all of the gas men of the state, asking them what they thought of the matter, and received so many favorable replies that he called a meeting at Fort Worth, July 7, for the purpose of organizing such an association.

Some eight or ten gentlemen were present at this meeting and telegrams and letters from a great many who could not be present were read, stating they were in hearty accord with the movement.

Feeling that it was a sense of the fraternity to organize, the meeting proceeded to form a Texas Gas Association, and elected the officers and directors to serve till the next meeting.

I understand we have in the state about fifty gas companies nearly equally divided between natural gas and artificial gas, so it is apparent that we must not expect to have a large membership, though it seems probable that in the course of a year or so our membership should exceed the hundred mark. At the preliminary meeting it was ordered that the membership dues be $5.00 for one membership in any one company, and $2.50 for each additional membership by the same company, making it an inexpensive proposition for two, three or four representatives from any company to belong to the association.

The purpose of this association should be that of disseminating knowledge; scientific and practical in all matters relating to the management, construction and operation of all kinds of gas properties; the establishing and maintenance of a spirit of fraternity between its members by social intercourse and exchange of information and ideas on gas subject; to study methods of encouraging a more friendly relation between gas companies and their patrons. These are the purposes of the Southern Gas Association, and I think it covers our requirements pretty thoroughly.

We want to get the gas men of the state together once a year, if for no other purpose than to get acquainted and exchange ideas. Some of us have been in the state for years and scarcely know, and

are not personally acquainted with, over half a dozen members of the fraternity in the state. The Southern Gas Association was organized for the purpose of bringing the gas men of the South closer together. Their annual meetings are usually held on the Atlantic Coast or in some of the South Atlantic States; consequently, is so far away that it would be too expensive to expect many of the gas men of the state of Texas to attend these meetings, but we can arrange to have an association of our own and meet once a year in Dallas or Fort Worth during the State Fair week and obtain cheap railroad rates that would permit of nearly every gas man in the state to attend the meetings if he so desired.

Those opposing this organization claim we cannot exist on the income derived from nominal dues. My answer to this is that other states maintain their associations in this way. There are the Iowa, the Illinois, the Indiana, the Michigan and the Southern Gas Associations, all of which are doing good in their respective fields, at a small cost per member. Let's make the most of what we have.

"There is always an opportunity to do things. The man who has but the remnants of a suit of clothes upon his back can convert his shuffle into a walk, can sew up the rents and wash off the grime, but, does he do it?

"'If I only had what he has I would be happy,' is a fallacy and often originates with the one who does not utilize what he already possesses.

"Make the most of what you have and you will be so busy that there will be no leisure in which to work up a grouch.

"Every one likes to have a man of that kind around. They are so full of resource and cheerfulness that they act as a tonic upon the overfed and pampered.

"It has been said that in some people their wishbone is where their backbone ought to be."

You may not agree with me as to the time and place of holding our conventions. I simply suggest what I think would be best. It is for you to decide these questions. We should bear in mind that the purpose of these meetings is to give the members an opportunitty to get new ideas by listening to the papers read and subjects discussed at the sessions, and each one of us should make it a point to be present at every meeting.

It is all right to have a good time, and, when the sessions are over, it is expected that each one will map out his own particular line of entertainment, but what I want to emphasize is this, that we come here strictly for business at the expense of our companies, and in justice to ourselves and the companies we represent, we should take every advantage offered to gain information. The association can never be of any help to a member who comes to the meetings with no other purpose in mind than to have a good time.

There are a number of live subjects that the association should consider during the coming year, and I shall mention a few that have occurred to me as regards the artificial gas business.

Live Subjects to be Considered

There is the painting and protection of gas holders and metal work, especially in the coast cities. This is a matter that has been occupying the serious consideration of my company for several years. We are just finishing repainting a gas holder in Beaumont after we had removed all of the old paint with a sand-blast machine. This is an expensive process, but by using this machine we were able to clean about three squares a day and paint the same immediately. At the next meeting I think we could furnish you a very interesting history of this process of holder painting.

The recovery of by-products is another interesting subject to consider just at this time, especially, inasmuch as the ammunition manufacturers are searching the country for material for making explosives. All of you, perhaps, have been offered handsome prices for drip water and other by-products around the gas plant that have heretofore been going to waste. There is a good market at present for calcium ferro-cyanide. It is possible at this meeting we will have a paper read which outlines how this calcium ferro-cyanide may be recovered from the iron oxide used in the purifier.

The State Fire Insurance Board has made a ruling penalizing the use of flexible gas connections within fire districts. This has caused the loss of some valuable tailor iron business to some of the gas companies in the state, and it is my opinion that the ruling cannot be justified except that it gives the insurance company another opportunity to levy a tribute upon the insurance public. I believe that this association should appoint a committee to prepare and submit arguments to the state Fire Insurance Board, showing them the injustice of this ruling, and I believe if this is done we can secure its repeal.

The commercial department of the gas companies of the state should prepare for us some valuable data upon the fireless gas oven range. There are a number of these ranges on the market to-day, and the gas companies should determine as soon as possible whether they have reached such a stage of perfection as would justify the gas companies in recommending them to their consumers.

Great progress has recently been made in the development of gas lamps for indoor and outdoor lighting. We have some lamps on the market now that are a credit to our business and it should stimulate the gas companies to go after more of the lighting business.

True Value of Light Oil in a Gas Lies in Its Effectiveness Per Unit Volume

J. W. Shaeffer Discusses Heat Values of Light Oil Scrubbed from Coke Oven Gases—Observed Heat Loss Due to Removal of Such Oil Considerably Greater Than Actual Loss

The loss in B. t. u. in the gas, as shown by calorimeter tests, due to scrubbing out the light oil is only slightly greater than the heat value of the light oil removed. For these calculations the heating value of light oil was determined by calorimeter tests and found to be 17,400 B. t. u. per pound of liquid light oil. To this was added the latent heat of vaporization of benzol, 167 B. t. u. per pound, as calculated from Smithsonian Physical Table No. 234. The heating value of the light oil plus the latent heat of vaporization gives 17,567 B. t. u. for the gross heating value per pound of light oil vapor. This value is considerably lower than the corresponding value for pure benzol, which is 18,793. This is accounted for, explained J. W. Shaeffer, manager of the Milwaukee Coke Company, in a paper presented at the annual convention of the American Gas Institute, by the presence of carbon disulphide and other impurities, which have a comparatively low heat value.

The latent heat is added in order to make the calculations comparable with calorimeter tests in which the light oil enters the calorimeter in the form of a vapor.

Determining Actual Loss in Heating Value

In determining the actual loss in heating value due to scrubbing out the light oil, calorimeter tests were made in the usual way on the gas before and after the scrubbers. The difference in B. t. u. divided by the B. t. u. of the gas before the scrubbers gives the percentage of actual loss. The calorimeter tests are understood to be the gross B. t. u. values.

The B. t. u. per cubic foot of the gas after the scrubbers was calculated as follows:

$$\frac{a - 121{,}827b}{1 - 35b}$$

Where a = The B. t. u. per cubic foot of the gas before scrubbing.
b = The gallons of light oil removed per cubic foot of gas.
35 = The cubic feet of vapor per gallon of light oil.

The constant 121,827 is the product of 17,567, the B. t. u. per pound of light oil; 7.3, the pounds per gallon of light oil, and 0.95, a correction factor correcting for the amount of absorbing oil in the light oil. The amount of absorbing oil is assumed to be 5 per cent. This figure varies considerably under various operating conditions; one plant reporting as high as 10 per cent, while others have only 4.

The average of all calculations shows a theoretical loss of 4.45 per cent while the actual loss as determined by calorimeter tests at these same plants is 4.62 per cent.

For a plant where the light oil is removed with a fair degree of completeness, these figures will be considerably higher, about 5.8 per cent. The above averages are low on account of their including plants which were scrubbing with a comparatively low efficiency.

Theory vs. Practice

These figures have shown that the actual and theoretical losses agree within the limits of probable error in calculation and determination. In contradiction to these facts is the belief of

TABLE SHOWING GAS ANALYSES, AMOUNT OF AIR REQUIRED FOR COMBUSTION, AMOUNT OF HEAT GENERATED, ETC.

Analysis per cent by volume		Required for combustion				Products of combustion			Amount of heat	
Before scrubbing		O_2	N_2	Air	Per cent of total air	CO_2	H_2O	N_2	B. t. u.	Per cent of total
CO_2	1.7	0.000	0.000	0.000	000.0	0.017	0.000	0.000	0	0.0
C_6H_6	1.1	0.082	0.312	0.394	008.0	0.066	0.033	0.312	41	7.4
C_2H_4	2.0	0.060	0.227	0.287	005.9	0.040	0.040	0.227	31	5.6
O_2	0.5	—0.005	—0.019	—0.024	—000.5	0.000	0.000	—0.019	0	0.0
CO	5.8	0.029	0.109	0.138	002.8	0.058	0.000	0.109	18	3.3
CH_4	30.0	0.600	2.268	2.868	058.5	0.300	0.600	2.268	297	53.7
H_2	52.0	0.260	0.983	1.243	025.3	0.000	0.520	0.983	166	30.0
N_2	6.9	0.000	0.000	0.000	000.0	0.000	0.000	0.069	0	0.0
Total	100.0	1.026	3.880	4.906	100.0	0.481	1.193	3.949	553	100.0
After scrubbing										
CO_2	1.7	0.000	0.000	0.000	000.0	0.017	0.000	0.000	0	0.0
C_6H_6	0.1	0.007	0.028	0.035	000.8	0.006	0.003	0.028	4	0.8
C_2H_4	2.0	0.060	0.227	0.287	006.2	0.040	0.040	0.227	31	5.9
O_2	0.5	—0.005	—0.019	—0.024	000.5	0.000	0.000	0.019	0	0.0
CO	5.9	0.029	0.111	0.141	003.1	0.059	0.000	0.111	19	3.6
CH_4	30.3	0.606	2.291	2.897	063.1	0.303	0.606	2.291	300	57.5
H_2	52.5	0.263	0.992	1.255	027.3	0.000	0.525	0.992	168	32.2
N_2	7.0	0.000	0.000	0.000	000.0	0.000	0.000	0.070	0	0.0
Total	100.0	0.960	3.630	4.591	100.0	0.425	1.174	3.707	522	100.0

many gas engineers that the actual loss due to scrubbing out the light oil is much greater than the calculated loss.

This belief is based on observations rather than on tests or calculations. The observed loss due to scrubbing the light oil out of the gas is likely to be considerably greater than the actual loss. This high observed loss is due principally to two causes. *First:* In practice only the net heating value of the light oil vapor is utilized, the moisture which is formed escaping in the form of a vapor in practically every instance where gas is used. *Second:* The opinion by observation is likely to be formed as soon as the light oil recovery plant is put in operation and before the readjustment of the air supply to the burners has been made.

In the accompanying table an analysis of by-product coke oven fuel gas is given, showing the amount of air required for combustion, the amount of heat liberated and other data. It will be noticed that benzene occupies only 1.1 per cent by volume of the original gas, but that it furnishes 7.4 per cent of the total heat which is liberated when the gas is burned; also that this 1.1 per cent of benzene requires 8 per cent of the total air which is required for combustion.

It follows from this that if the light oil be removed from the gas by scrubbing, then until the air supply to the burners has been readjusted, the heating will be affected in two ways: (*a*) the loss of nearly 7.4 per cent in calorific value, and (*b*) burning with an excess of nearly 8 per cent of air. This lowers the flame temperature and gives the appearance of a gas of a much lower heating value.

One interesting fact, which may be confirmed by a few simple calculations, is that the percentage decrease in flame temperature due to removing the light oil is less than the percentage decrease in its calorific power, provided the air supply to the burners is properly adjusted. This is true because the flame temperature of light oil vapor is somewhat less than the proportional average of the other constituents in the gas.

This table shows the analysis of coke oven gas before and after scrubbing. Some coke oven plants are producing an unseparated gas much richer than the one shown while others produce a gas of considerably poorer quality. The analysis does not represent an average of any number of plants. It is selected only as an example. The table is based on the volumetric relation which exists between the gas, the air which is required for its combustion and the products which are formed during combustion. The figures refer to a cubic foot of the gas under standard conditions.

CONCLUSIONS

The actual loss in the gross calorific value of the gas due to the removal of light oil is about 5.8 per cent at plants when the removal takes place with a fair degree of completeness.

The theoretical loss is practically the same as the actual loss. This is an average determination.

Some plants show a greater actual loss than the theoretical loss and some *vice versa;* all agree within the limits of probable error in determination.

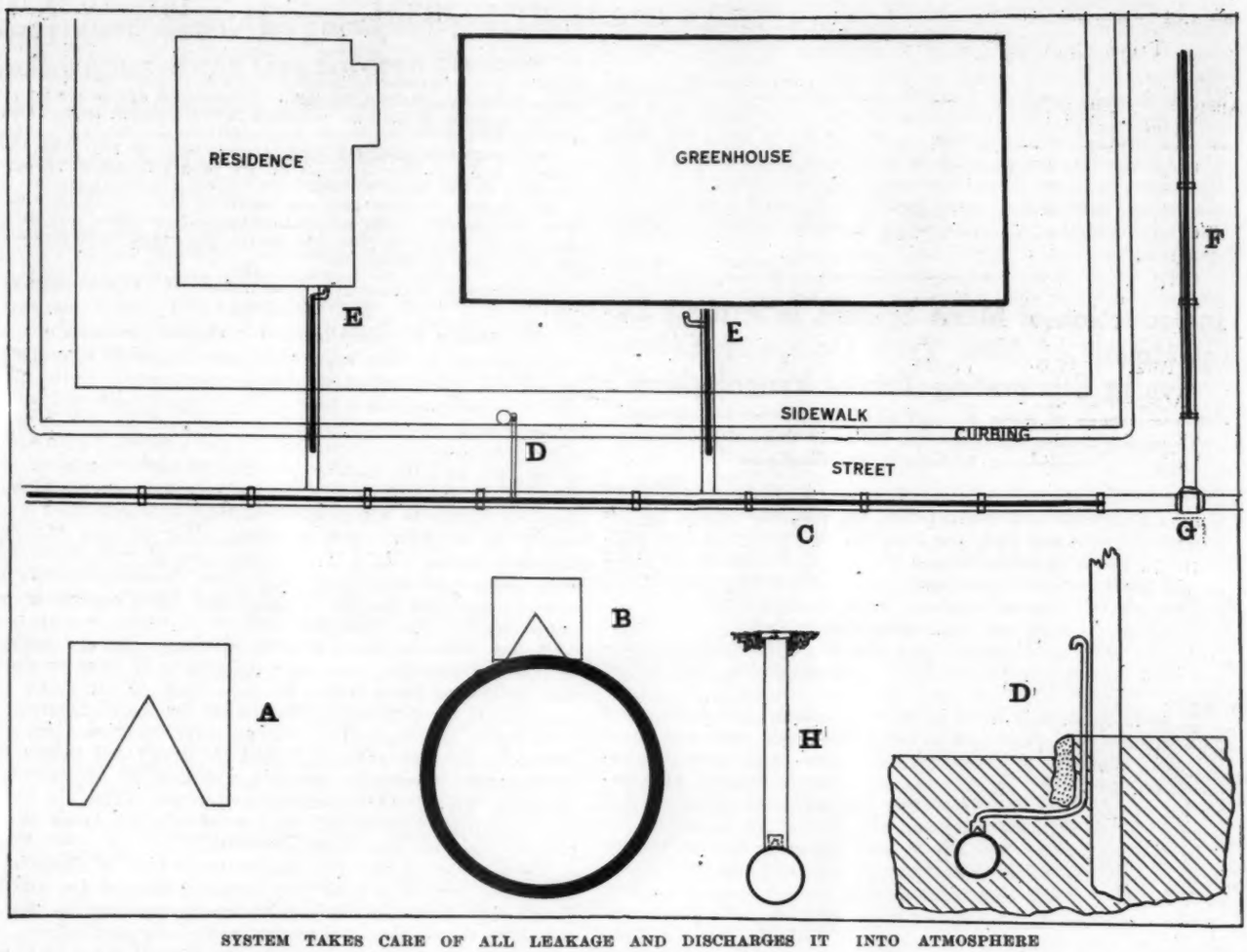
The observed loss due to the removal of the light oil is considerably greater than the actual loss. This is accounted for by the difference between the gross and net heating values and an improper adjustment of the air supply to the burners.

The observed loss has led many gas engineers to believe that the actual loss is greater than it really is.

The true value of light oil in a gas lies in its effectiveness per unit volume. One and one-tenth per cent of light oil by volume furnishing 7.4 per cent of the total heat, which is formed when the gas is burned.

Insufficient Publicity Responsible for Lack of General Understanding of Merits of Gas for House Heating

Current periodicals and literature on the subject of house heating indicate but little careful study of the use of manufactured gas for house heating and it appears as if it is categorically assumed that it is out of the question. For this trend of opinion we may be to blame for insufficient publicity as is indicated by a recent edition of a handbook on Heating and Ventilation, published by a well known engineer, in which the author has found it pertinent to add a short chapter on electrical heating and has made therein an approximate computation of the relative costs of electrical and coal heating, stated George S. Barrows and C. C. Winterstein in a paper presented at the annual meeting of the American Gas Institute. No similar comment, however, is to be found regarding the relative costs of gas and coal heating and the thought naturally arises, therefore, as to what the motive could have been which impelled this authority to span the breach between these two widely different methods of house heating while entirely ignoring the fuel "gas." It would seem that the electrical industry, despite obvious obstacles, has been able to demand a hearing in the consideration of this topic while the more logical fuel "gas," and we refer here to manufactured gas in particular, has failed to make a very deep impression.



SYSTEM TAKES CARE OF ALL LEAKAGE AND DISCHARGES IT INTO ATMOSPHERE

Device for Carrying off Gas Leaking from Underground Mains has Proved Effective in Preventing Injury to Trees, Greenhouse Crops, Etc.

Consists of Chemically-Treated Wood Sections, Grooved on Lower Side, which Conducts Gas to Vent Placed at the Proper Points—Also Facilitates Work of Locating Leaks—Installation Relatively Inexpensive

By GEORGE E. STONE

The writer has had many opportunities of observing the dissemination of gas in soils and to note some of the peculiar channels it will follow. We know of one street where gas has been leaking for many years and not a single tree has ever been affected. In this particular case the gas escapes in a conduit and is conveyed by the same to a vent system on a pole into the atmosphere a half or three-quarters of a mile away from the source of the leakage. The device illustrated and described here for the purpose of eliminating the injurious effects produced by gas leakage has been employed by the writer for some seven or eight years with favorable results.

This protection may be secured by laying a simple device, originated and used by the writer, over the gas main to convey the leaking gas to certain points above the ground, thus preventing contamination of the soil. By using a block system or applying it to sections 100 or 200 ft. long, or to each street block, as the case may require, and ventilating each section, a leak may be readily detected and repaired before it has an opportunity to cause any damage. By reference to the accompanying figure it will be noticed that the protective device covering the pipe line "C" is vented at "D" near a pole inside the curbing. Any leak, therefore, in the line corresponding to this block can be readily detected, and, by baring and eliminating portions of the protective system, the location of the leak can be accurately determined.

Device Described

The greenhouse and residence services are on separate systems and are vented at high points "E" to prevent access of the gas to the houses. The side street "F" is also on a separate line and should be independently vented. The union at "G" can be vented independently directly over the joint in the roadway by the use of ordinary iron shield provided with vent cap, such as is employed for gas shut-offs. The device made of chemically treated wood and shown in figure A and B is suitable for this purpose. It consists of pieces two inches square in cross section and of any desired length. This size may be adapted to any size pipe and secured to it by wires at intervals of 6 to 12 ft. More expensive and complicated systems have been devised for taking care of gas leakage but this system is simple, effective, inexpensive and readily installed. It takes care of all the leakage and conveys it into the atmosphere at definitely established points. If leakage occurs it can be readily detected and prevented from permeating the soil, where it would be likely to kill trees on the highway, or enter a conservatory. This protection should also be extended to house services to prevent injury to shrubbery and trees on private property. Even on established house service where the protective device has not been installed a vent system alone can be used to advantage.

We believe it is altogether too risky for any greenhouse to be located near a gas line without some form of protection, inasmuch

as the damage resulting from the contamination of the atmosphere and soil in conservatories is generally very great while the cost of installation of a protective device may be relatively small. The damage which may occur to greenhouse crops from air contamination is likely to be large and if the soil becomes poisoned the damage may be very much greater as it would necessitate the complete removal of the same which is likely to be an expensive operation.

Introduction of Merit System in Fitting Department of New York Company Effective in Eliminating Trivial Irregularities

These, though of Little Account when Considered Individually, Constitute Serious Impairment to Efficiency Collectively, Since Department Includes 1,200 Employees

The employees of the fitting department of the Consolidated Gas Company of New York, do all the company's work on the consumer's premises from the head of the service to the point where the gas is consumed, stated William D. Kelley, in his paper on the merit system for the employees of the fitting department, presented at the annual meeting of the American Gas Institute. This includes setting and exchanging meters, leaks, stoppages of all kinds, indexing, high bill complaints, and all other miscellaneous work necessary to the successful and satisfactory distribution of gas.

In addition to this there is the installation, exchanging, and maintenance in repair and adjustment of all appliances from the small domestic to gas-fired steam boilers, and when it is remembered that the appliance rental system obtains in all companies in the twin boroughs, the preponderance of labor contributed to the fitting department from this source is obvious.

In performing this work it is quite apparent how impossible it is to have the fitters and their helpers under the supervision of a foreman or superintendent at all times, or even for a very small percentage of the working day, scattered as they are over the entire city, except at a cost out of ratio to the result obtained. There is therefore, no alternative but to leave them largely to their own resources and the amount of work done or "Tickets Executed" depends solely on the individual's fitness, honesty, industry and his sense of fairness to the company. In a body of 1,200 men (there are about that number employed) there are the good, the bad, and the indifferent, but the superintendents of the different shops know them all individually and have in their minds a fair estimate of each man's ability and value. This opinion is formed by watching the number of completed tickets turned in by the different men, from the foremen's report, from occasionally inspecting the man's work on the district, and from his school record.

This method is intangible and unsatisfactory. The superintendent's judgment may not at all times be right, for no man is infallible, and, although he is in close contact with his men, an unconscious mental prejudice might unfairly operate against an employee's just advancement, as all recommendations for wage adjustments are made by the superintendent. This is a serious responsibility to place on one man's shoulders without some accurate standard helpful in appraising a man's worth.

It was with the two-fold purpose of creating this standard in shop operation and with the thought of encouraging the men in the faithful and intelligent performance of their duties and benefiting them according to their deserts, that the Merit System was inaugurated.

Principal Elements of System

The number of trivial irregularities, or offences to which employees are liable, which while of little account singly, when considered collectively are an impairment to efficiency, as well as a stumbling block to the proper maintenance of shop discipline. The introduction of the Merit System has in a large measure removed this trouble.

The principal elements of the system are:

A specific number of demerits are imposed for various infractions of the rules and for improper or unsatisfactory work, also for incomplete or incorrect reports.

Against these demerits four credits are given for a month's perfect work, that is, a month without demerits.

The credits balance or cancel a like number of demerits, which allows a man to improve his standing by good work. This is a very important feature of the system as it encourages a man to strive for a perfect month in order to better a previous month's standing, and prevents the employee from becoming disheartened due to a poor start.

The standing of the men is posted in the different shops at the end of each month.

Cash prizes are awarded semi-annually to those men with the best records, and also any increases in pay depend in a measure on their standing in the Merit System.

The system considers only the quality of the work done, and in no way the quantity. The superintendent is responsible for the execution of the work, and, from his reports, can usually ascertain whether or not a man is "soldiering."

Offences Warranting Discharge Not Considered in System

The number of demerits to be imposed was established by a committee of the shop superintendents who made a complete list of all the errors and omissions the men were liable to make in the prosecution of their work. Their report contained some 563 items which were reconsidered and reduced to 340 in number. These 340 errors or infraction of rules were then reviewed with great care and the number of demerits each was to carry was established, by considering comparatively their degree of seriousness in regard to the company's relation to consumer and the safety of the public and employee. The number of demerits imposed ranged from 1, for a slight clerical error to 15 for the more serious offences, these being those omissions of duty which would entail loss to the company and cause annoyance or inconvenience to the consumer.

Serious offences which warrant discharge are not considered in this system. For less serious infractions of rules an employee may be laid off for a time. He then ceases to participate in the semi-annual competition, but is eligible for the next period.

Demerits are imposed by the assistant superintendent or the clerks in the shop office who read the completed tickets to see if the work is properly reported and that the commercial department has all the information required. The district foremen who inspect the fitter's work on the district to see that it is properly executed also impose demerits.

All the offences and the penalty or number of demerits each carries are printed in book form, properly indexed and are posted in all the shops for ready reference by the men so that they can check the number of demerits received for each offence.

At the end of every month the standing of the men is posted in each shop on the bulletin. The ten men (if the shop employs 100 men) with the highest standing compose the first or honor section, the man with the most perfect record being first on the list, next best number two, and so on to the last man in the last section.

At the end of each six months, cash prizes are awarded to the five men in each of the ten shops who have the best records for the period.

As increases in pay are also largely based on a man's standing in the Merit System, this is an additional inducement for a man to keep a good average record by close attention to duty. In considering a man's record in the Merit System for wage adjustment due allowance is made for the new man at a low rate, as it is not expected that his record will be as perfect as the experienced fitter.

Men in High Standing Kept at Work Throughout Year

It is the policy of the department to keep the entire force steadily employed during the full year if it is possible. However, at times, due to the fluctuations in the volume of work or orders received at different seasons of the year, this is impossible, as in the spring and fall the work is very heavy, and then usually dull periods are encountered, during the summer, and at times in the winter months. During these dull periods it is necessary to decrease the force. This is done by laying off some of the men in the lower sections and rotating this among the men to make the individual burden as light as possible. It is only fair when this condition arises that the men with the better records are kept at work, and those who have a low standing be laid off, this forming another incentive for the men to maintain a good record in the system.

The Merit System has now been in operation about two years. Since its adoption the quality of the work has improved and the cost decreased. This is due largely to the fact that it is seldom necessary to go back to pick up any odd ends, or to obtain any information required on the tickets. Also less trouble is caused the consumer as fewer calls are made.

The men like the system and take great pride in their standing and are at all times working to improve their rating.

"Safety First" Should be Thought Uppermost in the Mind of the Gas Kitchen Planner

Appliances should be Installed at a Time when Customer's Service will not be Interrupted—Measures should be taken to Insure Expeditious Job; Even to Extent of having Trucks on Hand to Remove Old Coal Equipment from Scene

The sale of gas appliances to hotels, clubs, institutions, and restaurants while difficult to consummate, once made, the business resulting therefrom can be easily held and the returns to the local gas company form a very lucrative revenue, declared R. McKean Barry, in a paper presented before the National Commercial Gas Association at its annual convention.

Before the prospective customer is approached, the field of appliances should be carefully gone over and from it selected those appliances that appear to have the greatest merit. The appliance or appliances selected should be thoroughly tested in the laboratory before being submitted to the prospective purchaser. After this has been done, the company has something it can *guarantee* to its prospect and here is where a bond of trust is formed between the buyer and the seller that does more to cement a sale than anything else. A gas company should be willing, after its representative has studied the needs of the customer and selected the appliances, to submit the following guarantee:—

> "If, after we have modernized your kitchen, by removing your coal range and installing gas appliances, and you have cooked with gas exclusively, you should become dissatisfied, within a period of one year after the date of the completion of the work, with the changes made, we will remove the gas appliances and connections, credit your account with the cost of the appliances, and will reconnect the old coal range and replace the connections without charge; provided, however, no alterations are made to the equipment as installed by us."

The representative now equipped with the best goods and backed by an ironclad guarantee from his company, can enter any field armed to combat any argument, and has only to use judgment in fitting in the appliances that will give perfect service to the consumer. It may be well to state that the representative is called upon to act in the dual capacity of consulting engineer and salesman.

Object of Gas Company Should be Clearly Defined

With a new enterprise about to start, the kitchen planning and sale of gas-consuming devices is easier than remodeling an old kitchen. The architect and owner should be convinced that gas fuel is best and that the local gas company has for its sole object the sale of its product and is, therefore, going to install appliances that are the most efficient and economical, thus steering clear of maintenance charges and high-bill complaints.

The representative having the prospect should hold out for an "all-gas" equipment and can win his battle on the point that, with lax supervision in the kitchen where coal, steam, wood or charcoal is used in conjunction with gas, the cost of gas plus the other fuel is greater than where gas is used as a fuel exclusively.

Where an all-coal kitchen equipment is to be removed, the job for the representative is more difficult only in that it takes longer to close the sale. It has often to be done one appliance at a time, and the small appliance, such as toaster, griddle or waffle iron is usually the entering wedge.

The time-worn phrase "What is the other fellow doing on gas?" of the man with a kitchen using fuel other than gas, can safely be answered—"Never mind what he is doing, let us take care of you as we find you. The chances are that he is O. K. and your conditions are different." It is well to treat each case separately and not allow the prospect to get the kind of range "John Doe" has.

The purchaser must not alone be taken into consideration in making a sale, but the chef or cook, and the engineer. They should be shown the appliances you propose to sell them and instructed as to their simplicity of operation and control and made to feel that you are doing something for them also. Their suggestions should be carefully studied and if possible carried out.

Customer's Service should not be Interrupted

Appliances should be installed at a time when the customer's service will not be interrupted. Before the installation is made care should be taken to see that the service pipe is of proper size and a meter of adequate capacity to pass the proper number of cubic feet per hour has been installed. The representative making the sale of equipment should furnish the installation department a sketch showing the location of appliances, length and diameter of pipe, necessary fittings, etc., and should co-operate with this department at all times. He should be present when the installation is being placed to see that his plan is carried out properly and, if necessary, advise the superintendent in charge of placing the installation of any changes that might arise in the course of installing the appliances. Trucks should be on hand to immediately remove the old coal equipment from the scene.

In most every case of a complete change of kitchen equipment, the work should be done "over night." After an installation has been made it should be under inspection at least once a month, as long as it remains in service. This will pay, as it holds down complaints and helps get new business.

"Safety First" should be the thought uppermost in the mind of the gas kitchen planner. Do not forget the back draft check on flue pipes connected to blast or siphon ranges; dampers on vent pipes should be made so that they cannot close entirely. To approximate rapidly the percentage of heat lost up the flue on any appliances from flue gas analysis and flue gas temperature, the accompanying table on the following page has been compiled.

To interpret the table look for the percentage of CO_2 in the flue gas analysis, under the column marked CO_2; in column on the right will be found percentage of excess air; then find the flue temperature in degrees F. in the top line of the division of the table marked "Per cent Heat Lost up Flue," and corresponding to CO_2 in line under column, you will find per cent heat lost up flue for these conditions. This table will be found correct within two or three per cent until there is some radical change in the gas analysis of the flue gas. Increase in carbon in the flue gas accompanied by a like increase in heating value will tend to compensate and the table is still approximately correct for such variations as we ordinarily have in the manufacturing plant. Likewise a decrease in carbon accompanied by a decrease in heating value compensates in the same way. It would not be correct to

% Excess		Per Cent Heat Lost up Flue										
CO_2	Air	200	250	300	350	400	450	500	550	600	650	700
5.0	328	11.2	13.4	26.6	29.9	33.2	36.5	39.8	43.1	46.4	49.7	53.0
5.2	304	10.5	22.8	25.6	28.7	31.8	34.9	38.0	41.1	44.2	47.3	50.4
5.4	278	10.0	21.9	24.7	27.5	30.5	33.4	36.3	39.2	42.1	45.0	47.9
5.6	258	9.4	21.1	23.9	26.7	29.5	32.3	35.1	38.9	41.7	44.5	47.3
5.8	239	9.0	20.3	23.1	25.7	28.3	30.9	33.5	36.1	38.7	41.3	44.1
6.0	223	8.6	20.0	22.6	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
6.2	209	8.2	19.6	21.9	24.3	26.7	29.1	31.5	33.9	36.3	38.7	41.1
6.4	195	7.8	19.0	21.3	23.6	25.9	28.2	30.5	32.8	35.1	37.4	39.7
6.6	183	7.5	18.6	20.8	23.0	25.2	27.4	29.6	31.8	34.0	36.2	38.4
6.8	171	7.3	18.3	20.4	22.5	24.6	26.7	28.8	30.9	33.0	35.1	37.2
7.0	159	6.9	17.9	20.0	22.1	24.2	26.3	28.4	30.5	32.6	34.7	36.8
7.2	150	6.7	17.6	19.6	21.6	23.6	25.6	27.6	29.6	31.6	33.6	35.6
7.4	142	6.6	17.4	19.3	21.2	23.1	25.0	26.9	28.8	30.7	32.6	34.5
7.6	134	6.3	17.1	19.0	20.9	22.8	24.7	26.6	28.5	30.4	32.3	34.2
7.8	125	6.1	16.8	18.6	20.4	22.2	24.0	25.8	27.6	29.4	31.2	33.0
8.0	114	5.9	16.5	18.2	19.9	21.6	23.3	25.0	26.7	28.4	30.1	31.8
8.5	105	5.5	15.9	17.6	19.2	20.8	22.4	24.0	25.6	27.2	28.8	30.4
7.0	89	5.3	15.6	17.1	18.6	20.1	21.6	23.1	24.6	26.1	27.6	29.1
7.5	77	4.9	15.2	16.6	18.0	19.4	20.8	22.2	23.6	25.0	26.4	27.8
8.0	66	4.6	14.9	16.3	17.7	19.1	20.5	21.9	23.3	24.7	26.1	27.5
9.0	49	4.2	14.3	15.8	16.7	17.9	19.1	20.3	21.5	22.7	23.9	25.1
10.0	35	3.9	13.9	15.0	16.1	17.2	18.3	19.4	20.5	21.6	22.7	23.8
11.0	24	3.6	13.6	14.6	15.6	16.5	17.5	18.5	19.5	20.5	21.5	22.5
12.0	14	3.4	13.3	14.3	15.3	16.3	17.3	18.3	19.3	20.3	21.3	22.3

Not good if there is CO in flue gas.

make this statement for large variations, but it will hold good until there is a radical change in the gas analysis. The gas analysis to which this table applies is:—

CO_2	111	O_2	CO	CH_4	H_2	N_2
3.0	6.5	.4	19.4	22.7	45.3	2.7

Appliances using gas in kitchens of hotels, clubs, restaurants, lunch-rooms and institutions, can be classified as follows: —

Hotels: Bain Marie, reel bake oven, broiler, cake griddle, candy stove, coffee roaster, dish-washer, egg boiler, hot plate, incinerator, laundry appliances, plate warmer, proof box, ranges (spot burner for short orders and blast or siphon for heavy or continuous cooking), refrigerating appliance (absorption), roll warmers, salamander, steam table, steam kettle, steam boiler, toasters, urns, waffle irons, water heater (multi-coil storage).

Clubs: Bain Marie, cabinet bake oven, broiler, cake griddle, dish-washer, egg boiler, hot plate, incinerator, laundry appliances, oyster roaster, plate warmer, proof box, ranges (spot burner for short orders and blast or siphon for heavy work), refrigerating appliances, salamander, steam boiler, steam table, toaster, urns, waffle irons, water heater (multi-coil storage).

Institutions: Reel bake oven, broiler, cake griddle, coffee roaster, dish-washer, egg boiler, hot plate, incinerator, laundry appliances, plate warmer, proof box, ranges (spot burner), refrigerating appliance, steam boiler, steam kettle, toaster, urns, waffle irons, water heater (multi-coil storage).

Restaurants: Bain Marie, broiler, cake griddle, dish-washer, egg boiler, hot plate, incinerator, laundry appliances, plate warmer, ranges (spot burner for short orders and siphon burner for heavy work), refrigerating appliance, roll warmer, steam boiler, steam kettle, steam table, toaster, urns, waffle irons, water heater (instantaneous).

Lunch Rooms: Cake griddle, dish-washer, egg boiler, hot plate, incinerator, plate warmer, ranges (spot burner), steam table, toaster, urns, water heater (instantaneous).

The required chemical tests can be taught any intelligent foreman in a few hours; and the necessary calculations can be made mechanically. The testing solution can be purchased already made up so that the entire testing equipment need not cost over $15 to $20, and its use involves merely the simplest and most elementary forms of procedure.

Without constant supervision, it seems certain that any method, either of purification or the use of compounds, will inevitably fail to be successful; and on the other hand, with intelligent supervision the simple addition of properly prepared mixtures of lime and soda ash to the water—either in a tank prior to the admission of the water to the boiler, or in the boiler itself—cannot fail to result in a noticeable saving in cleaning, repairs, fuel, depreciation of the boiler, ability to carry higher loads, and greater safety and continuity in operation.

Favorable Character of Consumption Gained

Special appliances can be built to suit the needs of the consumer and should be added to this list. The Chinese restaurants open to gas companies a field for the sale of "high power" burners which can be substituted in their "Mo Hong Loo" in place of coal and coke. These restaurants are generally all night burners of gas, and thus high load factors on the distribution lines.

The very favorable character of the consumption added to the gas companies by these installations is graphically shown in a number of curves which have been plotted from actual records of consumption taken hour by hour from a number of hotels, clubs, hospitals, etc., in Baltimore, and are attached to this paper. On these sheets have been plotted the characteristic load curves of the installation, together with the load curve of the company's output of gas for the same period.

The advertising department of a company can be of great help in placing new installations, by judiciously placing before the public photographs of gas installations previously made. It has been the practice to show photographs of the kitchen before their change to all-gas equipment, but we find that some consumers object to this owing to the unsightly conditions that exist in their kitchens where coal is used as fuel.

In conclusion, let me strongly urge gas companies to insist that the manufacturer of appliances pay more attention to the improvement in efficiency, design, and stability of construction of their goods, to the end that increased sales and minimized maintenance may result.

Consideration of Convenience of Consumer Noteworthy Feature of Chicago Company's Credit System

Exchange of Credit Information Among Gas Companies has Resulted in Good to Company and Consumer—Gas Turned on at Earliest Possible Moment and Investigation Made at Later Period

The credit methods of gas companies in the past have not been based on any fundamental or recognized rule, asserted Robert Blair, of the Peoples Gas Light & Coke Company, of Chicago, in a paper presented at the annual meeting of the American Gas Institute. Each seems to have drifted along governed by local conditions, and most of them with hide-bound rules for cash deposits required from new customers to secure the payment of bills.

It is apparent from replies received to inquiries sent to other gas companies throughout the country, regarding the credit standing of some customer recently moved to Chicago, that many of the smaller companies still adhere to narrow credit rules, while a number of the larger and some of the smaller companies have adopted more liberal policies, which have proved of mutual benefit.

The exchange of credit information between gas companies has resulted in good to the company and consumer. In this manner a delinquent is frequently located for the company from whom inquiry is made, or if the applicant has a good credit record it is only justice for one company to furnish such information to another company, thereby establishing a credit record for the customer, who is a stranger in a strange land. If the record shows prompt payment for a customer while he was living in Milwaukee, it should be taken as an index that he will be equally as good pay in Chicago.

In the foregoing, reference has been made only to new customers who occupy flats and residences. In extending credit to new customers engaged in business, consideration must be given to the nature of the business, location, reliability, rating, hazard, bank reference and many other things.

Several years ago The Peoples Gas Light & Coke Company required its customers to furnish satisfactory credit information before turning on the supply of gas. It even required the customer's signature to an application before turning on the meter.

As the population of the city increased, it was found necessary to establish a number of branch stores and to improve and increase the facilities for receiving applications for gas at these branches and by telephone.

It was found that branch stores and telephone service soon became very popular, for the reason that service to customers was expedited. A better feeling was also created between the customer and the company. When the customer learned that he could get reliable service by calling the gas company's office by telephone, and that a great deal of inconvenience could be eliminated by so doing, he was quick to take advantage of the opportunity.

All Customers Asked a Regular Set of Credit Questions

In 1915 this company received 45 per cent of all applications for gas by telephone and 26 per cent at branch stores.

It will readily be seen that under these improved conditions, it became necessary to improvise a credit system that would not impede quick service to customers. The following routine was, therefore, placed in effect and seems to have worked to the mutual benefit of the company and its customers.

All customers who make applications for gas, either by telephone, at the main office or branch stores, are asked to answer a regular set of credit questions, namely: Where did you last use gas in this city; if never in this city, where did you last use gas in any other city and the name of the company that supplied you? If the customer is an entirely new consumer he is asked to furnish the name and address of his employer, occupation and name and address of at least one reference.

Gas is turned on at the earliest possible moment and investigation is made with regard to credit information at some later period.

All applications for gas before reaching the Credit Department have been executed and the gas turned on pending the credit investigation. The Credit Department then assorts them into two classes, previous and new customers.

Those applications designated as previous customers show a class of patrons who formerly used gas and are moving from one address to another, ordering the gas off and on. This class of applications is taken in hand by a small night force of men who are qualified to pass on credit business of this sort. The reason for doing this work at night is that records are more accessible for investigation of the accounts, as the ledgers are in use continually during the day.

The customer's account at the address he is leaving is examined and if the payments shown thereon are reasonably prompt and the amount left unpaid not unreasonably large the final bill for the old location is ordered charged on the first bill rendered at the new location. The application is then approved and sent to the permanent file.

Where investigation develops conditions showing that the customer has been slow pay and the amount left unpaid at the time of moving warrants immediate attention, these applications are given to a collector at once for collection of the delinquent amount.

New Consumers

Applications received from persons who say they are now consumers are assorted into six classes and action taken thereon, as follows:

Class No. 1.—Applications which for various reasons do not show proper credit information. These are received largely from a transient class of people whose place of employment is indefinite, and whose occupation is such that credit investigation is necessary. They are also received from occupants of small places of business, restaurants, saloons, barber shops, and rooming houses, all of which are usually considered somewhat of a risk. In this class are also included a large number of applicants who are foreigners, and understand but very little English.

All of the facts referred to above seem to indicate that the best way to determine the standing of such applicants is by investigation on the applicant's premises or in the immediate vicinity and at his place of employment.

First of all it is necessary to ascertain if the right name has been given and that applicants are what they have represented themselves to be, namely, new consumers. This investigation is made by what we call "final bill collectors" who in turn become credit investigators when that class of work is given them to handle in conjunction with their final bill collections. The object, of course, in the street investigation is to determine whether this class of accounts can be carried without cash deposits.

The information obtained by these investigations is also of value for comparison with cards which are kept in a file in the Credit Department. These cards show records of the last address at which a customer used gas and left an outstanding bill. They also show all other delinquent accounts for a period of ten years, whether gas was used in the customer's real or an assumed name. Any other information regarding non-payment of bills, places of employment, etc., is entered on the card and the file is usually the first reference used when a new consumer or so-called new consumer makes application for gas.

Class No. 2.—This class consists of applications where place of employment given is such that employers can be written to and if favorable reply is received as regards length and permanency of employment the application is approved and sent to the permanent file. Applications of this kind are not sent out of the office unless an unsatisfactory reply is received.

Class No. 3.—This class shows applicant's place of employment with large manufacturing concerns where laboring classes are generally known by check number only. In such cases it would not be advisable to write to the employer. Therefore, a private reference is used, usually some neighbor or friend and if a favorable reply is received these applications are also approved and sent to the permanent file. If the reply is not satisfactory these applications then become part of class No. 1. This class is not sent out of the office unless developments show that such a course is necessary.

Class No. 4.—In this class of applications we find the names of persons living in good neighborhoods, owners of the property in which they reside, professional men, men with official positions with business concerns, etc.; in other words, a reasonably high class of people. This element, however, is very small compared to the whole and their applications are approved without further credit investigation.

Class No. 5.—Consists of applications where the place of employment is generally given and also the address of the gas company at some location from which the applicant has recently moved. The gas company given as reference is written to and the credit of the account established through that medium.

Class No. 6.—Composed altogether of business concerns who have established rating with Dun or Bradstreet. This class is disposed of according to the rating shown. If the consumption of gas is to be large and if there is any question about the rating as given in Dun's, a special report is asked for.

To enable us to give prompt service in turning on gas necessitates that applications be taken by fitters, turn-on men, solicitors, and clerks at branch stores. These employees not having very much knowledge of the operation of the Credit Department, frequently fail to obtain the proper credit information and most applications taken by them go into class No. 1. Constant effort is made to correct this condition, but apparently it is something that is hard to overcome. These employees may be efficient in their own line, but frequently fail to obtain essential credit information.

Deposits

When accounts have been investigated and it is found for various reasons that a deposit is deemed necessary to secure the payment of bills, such accounts are placed in a separate class. A form letter is sent to the customer to the effect that under our rules a deposit will be required as continuing security for the payment of gas bills and that on a certain day, which is usually forty-eight hours from the date of the letter, our collector will call to collect same; upon failure to collect, the collector serves a final notice which expires in forty-eight hours. If the terms of this notice are not complied with the supply of gas is discontinued by the collector. The entire operation from the inception of the application to a point where the gas is discontinued covers an average period of ten days. Experience and statistics show that the losses sustained where gas has to be finally shut off is proportionately very small compared with the benefits received by the large number of customers who desire prompt service and whose standing in the community entitles them to it.

The amount of deposit is generally based on the amount of consumption as shown by readings taken by the credit investigator and the minimum deposit is $5.00.

Our whole endeavor is to take as few deposits as possible and they are called for only where investigation develops a condition that indicates unless the deposit is secured we would sustain a loss.

It would be as futile to demand that customers pay a deposit of too large an amount as it would to ask for one of insufficient amount, for in this state gas companies pay interest on customers' deposits.

The Peoples Gas Light & Coke Company also accepts guarantees in lieu of cash deposits from patrons of the company who have established accounts in good standing and who are willing to act as guarantors. Signatures to guarantees are obtained both by collectors and by use of form letters. It should be borne in mind that the guarantee class is a very small percentage of the whole, but the one that needs the most care and attention.

The present system for handling consumers' applications as outlined has been in operation for several years with marked success.

Years ago when the taking of deposits was left to the application clerks there was an arbitrary rule that the deposit must be paid before gas would be turned on. This worked an injustice to the customer and to the company. Under the present system there is no snap judgment and a reasonable time is given to comply with the request for deposit, and also an opportunity given to customers to present their side of the case or give reason why the deposit should not be exacted.

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The Spirit of the Season

During the year now ending the AMERICAN GAS LIGHT JOURNAL has had ample reason to be thankful for the friends it has made during its fifty-eight years of existence. A history that covers so extended a period must of necessity be replete with intervals of successful attainment and occasional shortcomings. Throughout it all, however, the gas industry has loyally stood behind the journal, enthusiastically supporting it in all its endeavors to keep pace with its field, and generously condoning its faults when it has fallen short.

The last few years have been particularly trying ones to the gas journals, due to the tremendous upheaval that has taken place in the industry, and the rapid development that has occurred. To adequately fulfill its mission the class journal must lead its field. To accomplish this in the gas field has lately become a task of no mean proportions.

During the past few months the AMERICAN GAS LIGHT JOURNAL has made a resolute effort to maintain its proper relation to its field. For assistance and co-operation in so doing it called freely upon the industry, and in not one instance did it meet with anything but a whole-souled response. The journal has therefore good reason to cherish the warmest feelings towards the industry it serves, and to hope with especial sincerity that all those engaged in it will have the merriest of Christmases and a most prosperous New Year.

A Change in Size

Beginning with the first issue of the year 1917 the size of the AMERICAN GAS LIGHT JOURNAL will be changed to 9 x 12 in., the measurements most common among the technical journals of the present day. This will in nowise affect the quantity of information supplied to our readers, as a sufficient number of pages will be added to make up the difference.

This action has been taken at the request of a number of our readers, who suggested that the present size was unwieldy, and out of consideration for the large number who bind their copies and naturally desire uniformity in their bookshelves. Since it is possible to cater to the convenience of these subscribers, without taking anything away from others, the publishers of this journal consider that the step is one that should be taken.

The Rural Market and the Gas Business

The gas business during its whole century of existence has been almost strictly an urban business. Very little effort has been made to reach out into the rural sections and very little investigating has been done to ascertain whether or not such a course would prove profitable. The electric light companies have developed rural sections far more than gas companies. In fact if the gas business was compared with that part of the electric lighting company business which is conducted in communities which have had a gas supply as long or longer than they have had an electric supply the gas business would probably show a greater volume than the electric business.

As has already been stated the electric industry has to some extent developed the rural business, but it is doubtful if any public utility men realize the great possibilities which the development of the farm load offers. George F. Whitsett, editor of the *Harvester World*, gave the following very instructive and illuminating figures in a recent issue of *Printers' Ink*. He says that there are already used on the farms of this country some 30,000,000 hp. in tractors and engines. This is enough power to run all the trains and boats, spin all the wheels and pulleys of industry and still have some left. This load alone would make a very decided increase in present incomes if it could all be supplied by gas and electric companies. These figures, however, tell only part of the story. The present value of all the farm-work animals is about $3,000,000,000 or an amount almost as great as the total invested capital in both the gas and the electric light company industry. If to this sum is added the value of the engines and tractors, exclusive of gas engines supplied by

gas companies and electric motors we would find that the investment represented by the potential market for gas and electric service is considerably greater than the total amount at present invested in gas and electric service companies.

At the present time it is of course impossible to reach all of this market with either gas or electric lines. High pressure gas distribution, however, would place gas within the reach of many farms that are now beyond the lines, and the rapidly growing network of electric distribution systems is bringing electricity within reach of many farms. In fact some farmers now heat their homes in winter with electricity as well as lighting them and using the power for many purposes around the farm. Electricity and gas cannot be satisfactorily used at the present time for all the work being done by animals and tractors. Experiments that are now being conducted abroad, however, would lead one to believe that in case the price of gasolene and kerosene continues to soar there will be a market for gas as a fuel for tractor engines as well as for stationary engines.

The fact that it now costs more than a billion and a half dollars a year to keep the present army of horses and mules used on the farms going shows how large a market there is for power on the farms of this country. Surely such a large market even though at the present time it may appear completely out of reach is well worth careful study. All of this market, however, is not out of reach of the gas business. High pressure lines connecting small communities pass a smaller or a larger number of farms. The above figures indicate the desirability of paying more attention to these farms and using greater effort to develop the latent business.

The Gas Company and the Engineer

There has been, of late, a great tendency to minimize the relative value of the engineer to the gas company. This is not altogether unnatural. Most of our accomplishments in the past have been of an engineering nature. Our earlier engineers—many of them still living, and active—did their work so well that it seemed that little further improvement could be effected. Carbonizing machinery and methods of manufacture had advanced so far, for example, that it seemed that the last word in this matter had been uttered.

Then we were told that we didn't know how to sell our product. Subsequent developments bore out the suggestion. There ensued what might be termed the commercial age in the industry. The employing of an engineer became a mere incident in the day's work, while that of the new business manager or commercial manager became a quest. Instead of following out rational lines we became hypnotized by commercialism, selling methods, etc.

This journal does not desire to detract one iota from the need of praise that is undoubtedly the alert commercial man's due. It does, however, wish to caution the companies to cease subordinating the relative importance of the engineer to the commercial man in their esteem, and in the care they exercise in employing them. It is important that the gas company should possess both a good commercial man and a good engineer. To be without either would be a misfortune, but it would be less of a misfortune to have a good engineer and a mediocre commercial man than vice versa.

This was forcibly borne out by W. A. Ehlers, industrial fuel expert for the National Commercial Gas Association in his recent paper presented at the convention held in Atlantic City. Industrial installations were cited by him to show the need of making such installations on a strict scientific basis. We disagree, however, with Mr. Ehlers in the statement that in the case of domestic equipment such skill is not required. Though great advances have been made in this call of appliances, still we have not attained the highest efficiency that might be desired. No gas company should purchase a range, for example, to be placed in a consumer's house without knowing what that range will do, and why it will do it. A good salesman can make a great deal out of the merits of this or that class of burners, but the gas company should not buy until its engineer tells it whether the salesman's statements are founded on a true scientific basis or upon mere fancy.

Then there is the lighting field. Unquestionably, gas lighting needs more publicity, good salesmen, etc. But more than anything else, gas lighting needs the benefit of engineering knowledge and research to eliminate those few points of inconvenience that still exist.

In all branches, it is the same. Far from having sunk to a position of relative unimportance in the gas industry, the engineer stands out a being, a necessity, to a greater degree than he ever has been in its entire history.

A Point Worthy of Consideration

A reader, who has drawn the mistaken inference that the editorial policy of this journal is to endeavor to exercise a restraining influence upon the industry's tendency to throw the greater portion of its efforts into the pushing of one line of endeavor—industrial fuel—to the neglect of other more established fields, inquires pointedly if we do not think the course he believes we are objecting to is in reality the soundest business policy.

Undoubtedly, we do believe the industry should spare no effort in securing industrial business, even to the extent, if necessary, of marking time temporarily along other lines. This is undoubtedly at the present time the line of least resistance. The output that may be secured per unit of measurement is so vastly greater that the selling effort in proportion is very small.

By following such a course this journal believes that the ultimate effect on other branches of the business will be beneficial. The proceeds from the industrial field will provide us the ammunition to go after this other business on a much bigger scale than we could otherwise possibly undertake.

Service

"To the extent that things worth while are given to us in this world we must give back to the world a return in service." This statement is credited to Charles M. Schwab, but many men, in fact all truly successful men, are learning that it is true.

In the final analysis all will have to admit that the business which grows and which both in size and in prosperity outstrips all competitors is the business that is rendering the most and the best service. To-day people appreciate and are willing to pay for service. In all of our large cities there are great business institutions that have grown and prospered not because their selling prices were lower than those of competitors, but because of the service they render. Many of these concerns sell their goods at even higher prices than do their competitors. In fact a study of the oldest and most prosperous concerns enjoying the good will of all their patrons indicates that selling price has very little to do with it. In each case it will be found that it is service that counts. The individual or the company that renders no service will never win permanent success.

Gas men cannot afford to spend as much time and attention on the selling price of gas or gas appliances as they spend on the quality of the service that they render. Gas and electricity are now approaching the same basis. In the future the measure of the service that these two industries are rendering the communities they serve will be their comparative growth. If electric light companies grow faster than gas companies it will not be because they sell their product cheaper than the gas companies sell their product. In nearly all cases electricity costs more than gas. The greater growth will be due to the superior service that the electric companies render. If the gas companies render better service than the electric companies, gas companies will be bound to grow more rapidly and prosper to a greater degree than electric companies. It is all a matter of service.

Since service to business life is as essential as food to bodily life too much attention cannot be given to it. Service should be considered first, and cost and profits last, for, if the service is right, the cost and the profits will to a very great extent take care of themselves. The present day gas company owes the rendering of service to more than the consumers it serves. It must consider the general public, the manufacturer and the dealers and plumbers in its community.

Methods of Purifying Boiler Feed Waters

W. H. Fulweiler Discusses Water Treatment Methods and Describes Typical Purifying Plants at Gas Works—Considers Boiler Compounds for Small Works

Technical literature and the Patent Office records are both filled with methods for the purification of boiler feed waters. According to W. H. Fulweiler, of the Department of Tests of the United Gas Improvement Company, these may be divided generally into four classes:

The simple heating of the water to the temperature it would attain in the boiler, the treatment of the water with various chemicals—this might be subdivided into four classes: cold continuous, cold intermittent, hot continuous, and hot intermittent treatments,—the use of artificial zeolite, and miscellaneous treatments.

In the first class, that of simple heating, the theory is that when the water is brought to the same temperature as that existing in the boiler, all the precipitation will take place in the apparatus itself, in pans or other devices that can be readily removed and cleaned. The difficulty here, however, is that it entirely ignores the chemical and physical effects due to concentration; and, while it is true that the bicarbonates (the temporary hardness) are precipitated upon heating, this reaction takes place slowly, and in the ordinary apparatus of this type sufficient time is not allowed for the reaction to be completed, so that while some of the bicarbonates are precipitated in the apparatus, precipitation continues, and usually results in trouble in feed lines and in the boiler itself.

Calcium Salts not Precipitated at all

Since the effect of concentration is ignored, the calcium salts are not precipitated at all, and these, together with the magnesium salts, form 90 per cent of the scale.

It is in the second class that we have the greatest diversity of methods, apparatus and mechanical devices.

The theory of the chemical treatment of water may be expressed in the ionic form as follows:

Fe	requires 2(OH)
Al	requires 3(OH)
Mg	requires 2(OH)
Ca	requires (CO_3)
H	requires (OH)
HCO_3	requires (OH)
CO_2	requires 2(OH)

and following Stabler, the lime and soda required may be calculated from the following equations:

$$CaO = 0.00931\ Fe + 0.0288\ Al + 0.0213\ Mg + 0.258\ H + 0.00426\ HCO_3 + 0.0118\ CO_2.$$

$$Na_2CO_3 = 0.0167\ Fe + 0.0515\ Al + 0.0232\ Ca + 0.0382\ Mg + 0.462\ H - 0.0155\ CO_3 - 0.001163\ HCO_3.$$

This formula is not in a very convenient form and furthermore requires a complete analysis for its application. In our own work we make our treatment depend upon the determination of the temporary and permanent hardness, and assume that the following equations represent the reactions:

Precipitated by Sodium Carbonate (Soda Ash)

$$CaSO_4 + Na_2CO_3 = Na_2SO_4 + CaCO_3.$$
$$Ca(NO_3)_2 + Na_2CO_3 = 2NaNO_3 + CaCO_3.$$
$$CaCl_2 + Na_2CO_3 = 2NaCl + CaCO_3.$$

Precipitated by Sodium or Calcium Hydroxide.

$$Ca(HCO_3)_2 + 2NaOH = Na_2CO_3 + CaCO_3 + 2H_2O.$$
$$Mg(HCO_3)_2 + 2NaOH = 2Na_2CO_3 + Mg(OH)_2 + 2H_2O.$$
or
$$Ca(HCO_3)_2 + Ca(OH)_2 = 2CaCO_3 + 2H_2O.$$
$$Mg(HCO_3)_2 + 2Ca(OH)_2 = 2CaCO_3 + Mg(OH)_2 + 2H_2O.$$

Precipitated by Sodium Hydroxide and Carbonate.

$$MgSO_4 + 2NaOH = Mg(OH)_2 + Na_2SO_4.$$
$$Mg(NO_3)_2 + 2NaOH = Mg(OH)_2 + 2NaNO_3.$$
$$MgCl_2 + 2NaOH = Mg(OH)_2 + 2NaCl.$$
or
$$MgSO_4 + Na_2CO_3 = MgCO_3 + Na_2SO_4.$$
$$Mg(NO_3)_2 + Na_2CO_3 = MgCO_3 + 2NaNO_3.$$
$$MgCl_2 + Na_2CO_3 = MgCO_3 + 2NaCl.$$

The first and third groups represent the permanent hardness. The second group represents the temporary hardness.

We may have, however, three or possibly four cases to consider:

(A) in which the so-called permanent or non-carbonate hardness is just equal to the temporary or bicarbonate hardness. In this case, the addition of sodium hydroxide or its equivalent decomposes the bicarbonate to form an equivalent quantity of soda ash, which in turn decomposes the calcium sulphate. In this case, sodium hydroxide alone can be used.

(B) in which the temporary hardness is in excess of the permanent hardness. In this case, if we use sufficient sodium hydroxide to precipitate all of the temporary hardness we would have an excessive amount of soda ash formed; so that we use an amount of sodium hydroxide that reacting with the bicarbonate will form the correct amount of soda ash to precipitate the permanent hardness. The remaining hydroxide necessary for the temporary hardness is made up with lime.

Where Permanent Hardness Exceeds Temporary Hardness

(C) The third case would be that in which the permanent hardness exceeds the temporary hardness. Here a sufficient quantity of soda ash would not be formed by the reaction between the temporary hardness and the sodium hydroxide to precipitate all the salts causing permanent hardness, so that additional soda ash must be added to precipitate the remaining or excess permanent hardness.

(D) A fourth case occasionally arises where there is an excess of sodium bicarbonates.

It is somewhat simpler to consider the use of these three reagents, but practically the sodium hydroxide can be replaced by equivalent mixtures of soda ash and lime. A number of years of experience has seemed to indicate that the increased cost of the use of the sodium hydroxide is warranted, in view of the better purifying results obtained, the decreased amount of precipitate which must be removed, and the smaller amount of labor involved in the preparation and the handling of the reagents.

While there is a great diversity in the details of the various chemical systems the principle is much the same in all. They consist in means for accurately proportioning according to the water used, the necessary amount of reagents, lime, soda ash, sodium hydroxide, copperas, etc., securing thorough admixture with the water to be treated, allowing the reaction a certain time to reach completion, settling out the precipitate as far as possible and then filtering the water to remove the last traces of precipitate and suspended matter.

Diversity in Design of Apparatus for Handling Chemicals Used

There is some little diversity in design of the apparatus for adding the chemicals used, in the shape and size of the settling tanks, and in the method of filtering, but the principal differences are those indicated before, *i. e.*, whether the treatment is made in hot or cold water and whether it is continuous or carried out in "batches" or tanks.

In the discussion of the relative merits of hot versus cold systems, it is undoubtedly true that with heated water the reaction between the chemicals takes place more quickly, and required a somewhat smaller excess of treating chemicals to secure any desired degree of purification; and this results in a somewhat greater output (in gallons of water per hour) from a given size apparatus.

Such a system, however, generally required the use of steam to attain or control the temperature, and a certain amount of heat is lost by radiation or conduction from the water while in the system, so that there is frequently a loss of from 15 deg. to 25 deg. in the feed water temperature.

In discussing the continuous versus the intermittent system, the continuous system involves fundamentally an accurate method of proportioning the chemicals to the flow through the apparatus. This necessarily involves moving parts and attention to insure their proper operation, and the handling of milk of lime, which has a tendency to clog up everything it comes in contact with in pumps and piping systems.

In the intermittent system, which occupies very much more space, it is very easy to secure the correct addition of chemicals for each tank of water treated, but this involves more labor in the routine of operation, but it also secures greater accuracy in the treatment.

Use of Artificial Zeolite

The use of artificial zeolites is one of the more recent systems for purification. This is based upon a very interesting reversible chemical reaction. The zeolite is a $2SiO_2.Al_2O_3.Na_2O.6H_2O$ and has the property of exchanging its sodium ion with the calcium and magnesium ions in the water. When it has become saturated, the feed water is replaced with a 10 per cent solution of sodium chloride. Under the influence of mass action, a reverse action now takes place, and the calcium and magnesium ions are displaced by the excess of the sodium ion present. After washing out the sodium chloride the material is again ready to begin a new cycle. The zeolites are formed as a coarse granular mass of small pieces, and are contained in relatively small iron tanks.

There is very little labor involved, and the feed water is usually passed through a tank for 10 to 12 hours, and a salt solution for about the same length of time, so that for continuous operation two zeolite treating tanks are necessary, or storage with one unit. The only expense of the treatment is the preparation and cost of the salt solution, as the zeolite material seems to last practically indefinitely.

This method of treatment will produce a water containing absolutely no hardness, and has been very successful in waters containing a large quantity of magnesium salts, a difficult condition to handle by other systems. Its most serious disadvantage is the fact that it does not change the bicarbonate radical, and this occasionally results in an excessive amount of sodium bicarbonate, which may cause considerable trouble due to foaming. This condition can of course be overcome by a preliminary treatment with lime. However, even where considerable amounts of bicarbonates are present, the system has given very good results. It seems, however, that this method is better adapted for the preparation of very soft waters for dyeing, brewing, and other technical purposes than for boiler feed supply as its installation cost is rather high; and the difference between 0 and 60 parts per million of total hardness is not great enough in general to warrant the increased installation cost for boiler feed purposes.

There are a number of rather interesting methods of treatment coming under the fourth head, one of which consisted in allowing the water to flow over a series of aluminum plates which were freely exposed to air and sunlight. This system of operation actually gave very good results with some waters, but failed completely in the presence of any considerable quantity of iron or magnesium salts.

Another interesting system that was brought to the writer's attention was that which involved passing the water through a form of rotating mill containing a large number of small cast-iron balls. Investigation showed that at least one engineer was thoroughly convinced of the complete elimination of boiler troubles, due to the use of this device.

It might be fair to state that the writer never heard of any system of feed water purification, no matter how fantastic it may have appeared but that did not have one or more advocates who were thoroughly convinced of its entire success under their conditions.

It is manifestly impossible to go into all the details of construction and operation of the various methods of treatment, so that for purposes of discussion here, three systems of chemical treatment will be described and their results analyzed, *viz.*, the cold intermittent system, the cold continuous system, and the hot continuous system. It is believed that these three will represent typical American practice.

Cold Intermittent System

The purifying system in use at the Point Breeze Works of The Philadelphia Gas Company is an example of the cold intermittent system of purification. This provides water for a plant of some 4,000 horse-power, and purifies about 400,000 gal. of water per day. The water is pumped from the Schuylkill River below the city proper, and had the following composition in September:

Constituents	Parts per million
Total solids	316.4
Volatile and organic	88.5
Silica	11.3
Iron and alumina	11.0
Calcium bicarbonate	28.0
Calcium sulphate	74.6
Magnesium sulphate	51.7
Sodium chloride	51.3

This water is subject to considerable variation, and carries at times high percentages of suspended matter. The system consists of five 35,000-gal. wooden treating tanks, a 20,000-gal. purified water tank, two pressure filters, and the necessary solution tanks and pumps.

The raw water is pumped into one of the treating tanks and calculated quantities of the necessary chemicals are mixed in the chemical tanks and blown into the treating tanks while the water is being added with steam ejectors. When the tank is filled and all the chemical is in, it is agitated with air for 30 minutes. The tank is then allowed to settle for a time determined by the demand on the system. At the present time, we are treating 12 tanks per day. This allows 2 hours for filling, ½ hour for agitating, 5½ hours for settling, and 2 hours for emptying.

The purified water is then drawn off by means of a floating suction, care being taken not to disturb the mud that has settled at the bottom of the tank. The small amount of precipitate still remaining in the water is taken out by two sand filters. These are vertical cylindrical tanks 5 ft. in diameter and 10 ft. high, provided with false bottoms and filled with graded gravel and sand. The filters are washed out every day with a counter current of clear water. They require filling about every 3 years. The tanks are washed out about every 2 weeks, depending upon the season of the year.

The chemicals used in this system are sodium hydroxide, soda ash, and lime. The character of the water is such that soda ash is very rarely used. The operation is controlled by an analysis of purified water from each tank. This is necessary on account of the fact that the character of the water at times changes considerably in 10 or 12 hours. The system of control embraces a daily analysis of the raw water, analyses of the treated water from each tank, and analysis at intervals of the boiler blow-off.

The operation of the plant is regulated so that there is an excess causticity as NaOH equal to 60 parts per million and an alkalinity due to Na_2CO_3 equal to 150 parts per million.

The operation of this plant has been very satisfactory.

The boilers are blown down to hold the concentration of the excess alkali to about 350 parts per million. The boilers are tested every 7 days, and blowing down regulated accordingly. Since the present system has been in operation they have not lost a tube. Boilers are cleaned about every 100 days, and are operating at an average load equal to 144 per cent. of their rating.

We attribute the success of this plant to the constant chemical supervision which it receives, as it is the simplest installation possible from a mechanical point of view, the only moving parts being the swing suctions and the two steam pumps.

Cold Continuous System

As an example of the cold continuous type, the system in use by the Counties Gas & Electric Company, Norristown, Pa., will be described. This system is used to purify the make-up feed water for a station having a capacity of 2,500 boiler horse-power. The plant is rated for a capacity of 12,500 gal. per hour. During certain months in the summer, the demand is nil, while in the winter the maximum amount purified is about 6,000 gallons per hour. The raw water is pumped from the Schuylkill River about 18 miles north of Philadelphia, and had the following composition under the date given:

Constituents	Parts per million
Total solids	155.27
Volatile and organic	13.65
Silica	6.50
Iron and alumina	0.50
Calcium bicarbonate	15.90
Calcium sulphate	69.14
Magnesium bicarbonate	11.90
Sodium sulphate	19.05
Sodium chloride	18.63

It should be noted, however, that this water changes radically in its composition with the season of the year and the state of the river; and it frequently carries large quantities of coal dust, particularly in the spring.

Calculated weighed quantities of lime and soda ash are put into the mixing tank with water. The lime is slaked and the soda ash dissolved. Copperas is dissolved in tank. When thoroughly mixed and dissolved, the solutions are lifted by means of steam syphons to chemical tanks.

The agitator in the chemical tank is propelled by a water wheel

which is in turn propelled by the incoming raw water, and this keeps the contents of the chemical tank stirred when softener is in operation.

The water to be treated enters by way of an inlet pipe from a small overhead storage tank into the raw water box where it is divided. The inlet water is regulated by the valve controlled by the float. The major portion of this water flows through the large opening in the raw water box where it comes in contact with the water wheel, and from there into the top of the downtake. A small stream flows through an opening in the raw water box into a pipe which leads to a dividing box where it is divided, one part flowing into the regulating tank.

The function of the dividing box is to regulate the rate at which the water in the regulating tank rises compared to the rate of flow through the apparatus.

The heads of the lift pipes in the chemical tanks are connected by chains to a float in the regulating tank. As the regulating tank very slowly fills with water from the dividing box, the float in the regulating tank rises, the heads of the lift pipes are lowered, and the contents of the chemical tanks flow out through the lift pipe and are mixed with the raw water in the top of the downtake.

The reaction between the raw water and the reagents start as soon as they meet. The mixture flows from the mixing plate at the top of the reaction cone or downtake. The precipitation of the scale-forming ingredients in the water commences to take place.

Flowing at a constantly decreasing rate owing to the constantly increasing diameter of the cone, the water passes to the bottom of the cone, turns and flows at a constantly decreasing rate upwards, the precipitate falling away from it as it moves.

Finally the water passes on to and by gravity through the filter composed of about 2 ft. of excelsior and burlap which removes any trace of suspended matter and gives the soft treated water ready for use in the boilers.

The filter at Norristown is made of burlap and excelsior, but a quartz filter might be still more effective. It is necessary to replace the filter once a year. It requires 1,800 lbs. of excelsior and 3 or 4 days' time.

The precipitate falls to the bottom of the sediment tank and is removed once a day through a blow-off pipe or sludge valve into the sewer. The sludge is stirred by a crank and agitating arms, while the valve is open.

Testing Water

Satisfactory results are obtained by closely following the method of testing laid down by the makers. Tests of treated water are made three times every day. The tests are as follows:

For hardness measure out 100 cubic centimeters of treated water, place in bottle and add standard soap solution until permanent lather is formed. The number of cubic centimeters of soap solution added is called the hardness.

For alkalinity and causticity measure out 100 cubic centimeters of treated water, add phenolphthalein, also methyl orange, standard acid is added until red color changes to yellow. The number of cubic centimeters of acid added is called causticity. Run in more standard acid until the yellow color just changes to pink. The total number of cubic centimeters of standard acid required to produce both color changes is called the alkalinity.

The alkalinity of the treated water should be only a few points above the hardness, and the causticity should be about two-thirds of the alkalinity.

If results are not correct the makers supply a table by which the changes are changed until the results are correct.

These tests were made by the head fireman who also mixes the necessary chemicals and empties the regulating tank once a day and fills the chemical tanks. This requires about 2 hours per day.

It is difficult to form a correct idea of the real value of this system, as in the summer practically all the water comes from the condensers and in the winter it only operates at about 50 per cent of its rated capacity. Under these conditions, however, the results have been excellent. The scale is very light and they have lost but two tubes during the last 3 years. There has apparently been considerable gain in fuel economy. The annual boiler cleaning is very light, and the boilers here are operated at 150 per cent of their rated capacity. If this system were operated at its rated capacity, the reaction time would be 4 hours, whereas, at the present time, operating at the maximum rate, which is equivalent to 50 per cent of its capacity, the reaction time is 8 hours.

The method of mixing and adding the chemicals is simple and probably sufficiently accurate; a mechanical agitator in tank, however, would suggest itself.

The location of the chemical tanks in the more or less exposed upper house requires a considerable amount of steam to prevent their freezing during the winter. The design of the settling tank seems to be a sound one; but the location of the filter makes its care somewhat difficult. It seems to require about 4 days every year to properly renew this filter and give the interior piping the necessary attention.

Hot Continuous

As an example of the hot continuous process, that in use at the Station "B" plant of the Philadelphia Gas Works will be described. This furnished feed water for boilers having a rated capacity of boiler horse-power.

The raw water from the supply tank enters the top of heater through the regulating valve, which is controlled by a float valve in the pump supply. The heater is of the atmospheric plate type, provided with an oil separator. The makers require that the water should leave the heater at a temperature of 200 deg. Live steam, if necessary, is added to the water at the outlet of the heater. The chemicals, in proportional amounts to the feed, are introduced in the stream of water as it leaves the heater. Then it passes down through a 10-in. pipe into a vertical treating tank, 10 ft. in diameter and 23 ft. long, provided with a cone bottom and blow-off valve. As the precipitate is formed, it falls with the water to the bottom of the tank and is deposited and blown off at intervals. The cleared water rises through a central funnel and 10-in. pipe to two filters above the treating tank but below the heater. These filters are 10 ft. 6 in. by 4 ft. 3 in., provided with an 18-in. layer of excelsior having a total filtering area of, roughly, 90 sq. ft. The water rises through the filter due to the heat from the heater above, which is equivalent to about 2 ft. 6 in. An overflow is provided about 18 in. above the filter bed in case the filters become clogged. From the filters, purified water flows through the regulating float box to the boiler feed pumps.

The chemicals are mixed up in tank, which is provided with electrically driven stirrer. The centrifugal pump circulates an excess amount of the liquor through a valve. The lift of this valve is controlled by a piston which, in turn, is controlled by the differential pressure set up by the insertion of a disc in the feed pipe to the heater. If the flow is normal, the piston is balanced at a certain position and the valve remains practically closed, causing sufficient back pressure to force a portion of the liquid up through a by-pass into the funnel, hence to the smaller centrifugal pump by which it is fed to the apparatus. The excess liquid overflows back again to the tank and is recirculated.

If the flow, however, is decreased, the lift of the valve is increased so that the bulk of the solution overflows back into the tank, a smaller quantity is forced up through the by-pass. A small motor drives the two pumps and the stirrer.

The rated capacity of this system is 12,000 gal. per hour, and at the present time it is operated at the rate of 8,000 gal. per hour. At this rate, the reaction time is about 82 minutes, and the temperature from 190 to 200 deg. Fahr. At full capacity, the reaction time would be reduced to 55 minutes.

The principal feature open to criticism would seem to be the short reaction time allowed at rated load and the use of two filters with such a small head. If one filter becomes slightly clogged, an excessive amount of water is forced through the other filter. This results in a small amount of precipitate passing on into the boilers. There is also some evidence of precipitation taking place in the boilers. This may probably be attributed to the short reaction time allowed.

The chemicals used at present are lime, soda ash and copperas, and the charges are based on the chemical control of the filtered water made twice a day. For sometime soda ash alone was used, but the operation could not be controlled efficiently. Recently the lime-soda ash-copperas mixture has been used, and the treatment has improved greatly. The plant is operated so that the treated water requires 1 cubic centimeter of N/20 acid for the causticity and 2 cubic centimeters of N/20 acid for the alkalinity for 100 cubic centimeters of water. This would be equivalent to 75 parts per million.

The raw water is pumped from the Delaware River above the city proper but within the manufacturing zone, September, 1916.

Constituents	Parts per million
Total solids	65.4
Organic and volatile	3.6
Silica	10.0
Iron and alumina	1.7
Calcium bicarbonate	11.3
Calcium sulphate	21.9
Magnesium carbonate	9.9
Sodium chloride	7.0

The composition of the water, however, is subject to very considerable variations, which depend upon the season, the state of the river, and the tide. This makes careful chemical control imperative.

The boilers are cleaned every 100 days, and are operated at about 122 per cent rating. As yet, there is still considerable scale, and they lose on an average between four and five tubes per year. It cannot be said that the operation of this plant is entirely successful, but the results are improving and it is hoped that future work will render it more satisfactory.

Boiler Compounds

It will be seen, therefore, that it is possible, with the aid of a properly designed and operated system, to eliminate such a portion of the deleterious ingredients in boiler feed water that the boilers can be safely driven considerably above their rating, and boiler repairs and cleaning reduced to a minimum, with the consequent saving in fuel and labor, and generally increased efficiency. But these systems cost a certain amount of money and require a certain installation of apparatus, so that in many of the smaller plants recourse is had to the use of so-called boiler compounds.

If we do not remove the scale-forming ingredients before they enter the water, our only recourse then is to so treat the water that when these ingredients are precipitated, they will come down in the form of loose, amorphous powders, which will not adhere to the tubes, with the resulting formation the compact, crystalline deposit, known as boiler scale. We might easily fill a page with a list of substances that have been exploited for use in the treatment of feed waters: Ten levers, oatmeal, potato peelings, molasses, kerosene, graphite—nothing seems to be too fantastic. Yet all of them seem to work under certain conditions. They might be divided, however, for purposes of discussion, into three general groups, according to their apparent method of operation, *viz.*, chemical, collodial and mechanical.

The chemical compounds comprise a large number of materials, such as soda ash, sodium silicate, sodium fluoride, disodium hydrogen phosphate, sodium bichromate and barium salts. Fundamentally, they are intended to cause the precipitation of the calcium and magnesium salts, that cause the permanent hardness as carbonates, as the carbonates come out as loose, porous precipitates; while the sulphates of calcium and the hydrate of magnesia would form dense scale. Since soda ash is the cheapest, it forms the basis, and the greater part, in fact, of most of these compounds. A typical analysis of one of these compounds is as follows:

Typical Analysis of Boiler Compounds

	Per cent.
Moisture	17.05
Sodium carbonate	70.11
Sodium chloride	Trace
Undetermined	0.96
	100.00

Cost six (6) cents per pound.
Cost of ingredients at current price, 1913, 2.62 cents.
Sodium hydrate 11.88

In the second class are compounds usually of vegetable or organic nature, that seem to depend for their successful use on preventing the particles of precipitated material from adhering to the tubes, and causing them to go down as a fine mud. The basic ingredient seems to be a tannic or a related acid, and their action seems to be that of a protective colloid, in that it causes the precipitation of the salts as amorphous powders, and not in a crystalline form. This action of tannic acid is well known in its use in the manufacture of colloidal graphite and in the manufacture of clay. Of the other organic materials that have been used for this purpose, these probably decompose at the temperature in the boiler, forming acids that have this same useful action.

Many of these compounds also contain a certain amount of soda ash to assist in precipitating the salts causing the permanent hardness, in a less harmful form, and to neutralize any free acids that would interfere with the protective action of the tannic acid.

In certain waters, compounds of this class are frequently very successful while under other conditions they seem quite useless. The presence of considerable quantities of magnesium salts, and the sulphates and chlorides of sodium, are apparently inimical to their successful use.

The third class of compounds attempt to prevent the formation of hard crystalline scale by their effect on the surface of the iron in the boiler so that the scale either does not adhere, or is broken up as soon as it attains any thickness. Graphite and kerosene belong to this class; and as usual with this system of treatment, excellent results have been reported, and again complete lack of success.

A fundamental difficulty in the use of boiler compounds would seem to the writer to be the fact that no attempt seems to be made generally to control the quantity of compound used with the variations of the boiler feed; and with the concentration of the material that must take place within the boiler itself. Furthermore, all of these compounds are relatively expensive. Lime and soda ash are two of the cheapest commercial chemicals, and it would seem, therefore, that since some supervision is essential, that by properly supervising the application of calculated quantities of these two reagents we would secure at a minimum of expense practically all of the advantages that any of the patented, and therefore, much higher priced materials could possibly possess.

For comparison, the results of using patented boiler compounds and calculable mixture of lime and soda ash at the plants are included in the following table of costs that exhibits the labor cost, the cost of supplies, repairs and depreciation, in the three types of purification systems, and in the two plants using boiler compounds.

No attempt has been made to credit the water purifying systems with any economy due to fuel saving.

From this it will be seen that taking everything into consideration from a cost standpoint, the installation of a water purifying system is not an expensive luxury. In the writer's opinion, it is fundamentally a question as to whether the plant can afford to allow a man with fair general knowledge to devote an hour a day of his time to the supervision of the treatment.

Table of Comparative Costs of Treating Boiler Feed Water

Plant system	A Boiler compound	B Boiler compound	C Boiler compound	D Cold intermittent	E Cold continuous	F Hot continuous
Original total hardness of water	6.20	15.90	23.10	10.0	5.18	3.27
Labor operating	0.150	Nil	Nil	0.732	0.350	0.255
Chemicals	1.019	4.740	5.120	1.865 (B)	0.563	1.010
Repairs purifying plant	Nil	Nil	Nil	0.031	0.336	0.212
Interest and depreciation	Nil	Nil	Nil	1.180	2.380 (C)	1.698
Total purifying cost	1.169	4.740	5.120	3.808	3.629	3.175
Cost per grain total hardness	0.188	0.298	0.221	0.381	0.700	0.971
(A) Cost calculated at 3.27 grains	0.615	0.975	0.722	1.250	2.300	3.175
(B) Cost cleaning boilers	3.090	1.980 (A)	3.750	1.181	1.300	2.210
Reference figure (A + B)	3.705	2.955	4.472	2.431	3.600	5.385

The above figures are in cents per 1,000 gallons of feed water treated. A.=Low cost due to large units and moderate load. B.=High chemical cost due to use of caustic soda at war prices. C.=Excessive cost due to small quantity treated in a large plant.

News of the Gas Industry

St. Joseph (Mo.) Company Now Using Artificial Plant

St. Joseph has begun using manufactured gas, the natural supply having diminished at the rate of 100,000 cu. ft. an hour the previous morning. The pressure in the incoming natural gas mains went down from seven pounds to two pounds, and the pressure pumps had to be put on to keep up the supply in the distributing mains. It was predicted that with the cold weather the natural gas supply would about wink out and that the pressure would be down to one pound at least. Ten pounds is the pressure that should be delivered in the supply mains.

The gas company, anticipating a shortage of gas, has had its fires in the manufacturing plant for several days, when the holders began to empty at the rate of 100,000 feet an hour in addition to all that was coming through the mains, the manufacture of gas was begun. By thus anticipating the wants of the public, there was no serious inconvenience to consumers and the shortage may not last long.

Gas Wins for Can Factory Installation

Three years ago the Stokes Canning Company moved to Denver, from Colorado Springs, its business being the canning of chile con carne, and other Mexican dishes. This firm has expanded to such a degree that it has been necessary to work night and day to average an output of 2,000 a day. As the Stokes Company has a call for an output of about 10,000 cans a day a factory to care for this increased output was found necessary. The officials of the company had practically decided to install a steam plant of its own, but the aggressive salesmanship on the part of Denver representatives induced them to install electric drive furnished by the Doherty Company. As a final conquest, the Denver Gas Company has succeeded in having the canning concern do all its cooking in the new factory with gas.

Chicago Gas Company Makes Better Offer

W. G. Woolfolk, an engineer representing the People's Gas Light and Coke Company, yesterday made an unexpected plea for speedy action by the city on the company's proposal for a change in the municipal standard for its product.

"I must ask you to be brief," said Mr. Woolfolk. "It may be cruel to talk about war profits; but it is, nevertheless, true that our company plans to reap a profit in 1917 by selling oils used in the manufacture of war munitions, and the purchasers of these oils, the company believes, will not care to buy after 1917.

"These oils are by-products obtained through washing the gas. They cannot be obtained, however, as long as the present standard of twenty-two candle power and 670 British thermal units is required."

Mr. Woolfolk, for the company, agrees that if the candle power requirement is reduced, consumers using flat flame burners shall be given two mantles free.

Franchise Limit

Herbert J. Goudge, counsel for the Los Angeles Gas and Electric Corporation, has informed the Board of Supervisors it was a hardship on the corporation to hold it to the three-year limit for construction work under a franchise. The board was told seventy-five laborers would have to be dismissed because of the restriction, and a longer period was urged, since construction work by a large corporation is never completed.

The board was disposed to make no change in the existing ordinance determining the life of a franchise, but finally referred the matter to the county counsel to report on the advisability of redrafting the ordinance.

The Southern Counties Gas Company, represented by Attorney Beach, conferred with the board on the question of permits. The people of Sunny Slope are anxious to have the corporation proceed with the work of laying mains, so it may have gas. This territory has an area of three and one-half miles. Supervisor Woodley suggested the areas for construction work are too large and thought matters would be better if they were reduced in size. NEWS

Manchester (Conn.) May Get Cheaper Gas

Preliminary steps have been taken by the South Manchester Light, Power & Tramway Company for the transfer of its gas franchise and business to the Hartford City Gas Light Company. Application will be made to the incoming session of the General Assembly for legislation which will permit this transfer.

In speaking of the matter this morning, Frank Cheney, Jr., president of the South Manchester Light, Power & Tramway Company, said that arrangements had been completed to carry the deal through as soon as the action was made possible by the legislature. The preliminary agreement with the Manchester Company called for an initial reduction of 25 cents per 1,000 cu. ft.

Extent of Car Shortage

On Sept. 1, there was a car shortage in the United States of 19,000; Oct. 1, 60,000; November 1, 108,000; December 1, approximately 150,000 with the probability that shipping conditions will continue to become worse from week to week.

Junior Stoves Advertise Gas Ranges

Children make excellent boosters. Once their interest is aroused they can do wonderfully effective work in giving publicity to a dealer and even in directly increasing the sale of his goods. The plan adopted by the Rhodes-Burford Company, of Louisville, Ky., in appealing directly to the children, is one that could be emulated successfully in many sections.

They advertise their gas ranges in the papers, and also the display of junior ranges; but their most effective advertising is done through the medium of their show window. In the background are several modern equipped gas ranges, while in front, set on a stout bench, is a diminutive gas range at which two little girls (wax models) are gazing delightedly. A card set against the base of the bench says:

GIRLS:—This Junior Gas Range Free, with Any Standard Gas Range Purchased in This Store.
It Really Cooks and Bakes.

The catchy sign and the little stove attracts much attention among the little girls, and sets them to begging their mothers, cousins, aunts, in fact, anybody they know to buy one of the big stoves in order that they might get a Junior for their own use.

Wants State to Fix Coal Prices

Preparedness on the part of the rich man are among reasons advanced by Boston coal barons for the alleged shortage of coal and prevailing high prices.

It is alleged that the rich man, so-called, last Spring stocked his coal bins with sixteen tons of coal when in years past he only put in four tons.

Another reason is that manufacturers are running night and day and are using twice as much coal as formerly.

All coal delivered in Boston to the wholesale and retail dealers comes by boat from the coal mines. All coal outside of Boston goes by rail. That is one reason given why coal is cheaper in Boston and higher outside, in that people in the latter places have to pay the railroad rates in part.

Investigators who have made an exhaustive study of coal conditions and persons who have been active in the investigation of the high cost of living declare that the coal barons are up to their old tricks in trying to shift the alleged coal shortage and high price propaganda onto the consumers again.

If the gas company wants to increase the price of gas it is necessary for the officials of that company to appear before the Gas and Electric Light Commission and give a valid reason. If the reason is not valid then gas remains at the same price. This is true also of the Public Service Commission with reference to a railroad or street railway company wishing to advance the price of transportation per passenger. The railroads must give a valid reason. Isn't it fair to assume that the State have a coal commission so that if it becomes necessary for the coal dealers to increase the price of coal the commission could be in a position to say whether a valid reason was given for the increase? In that way the poor man would not have to suffer, as the prices would be shared alike by rich and poor.

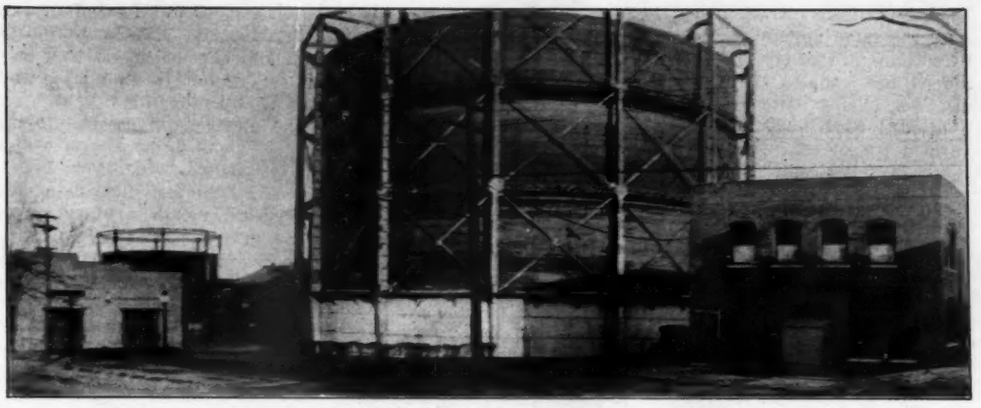


PHOTO ON BACK OF MENU WAS REMINDER OF GAS COMPANY'S PROGRESS

Minneapolis Company Builds New Sub-Station and Service Building

The Minneapolis General Electric Company (Northern States Power Company) has started construction of a new sub-station and service building in Minneapolis. The building will have a 375 foot frontage on Chestnut Avenue, and extend 200 feet on 16th Street. It will consist of a basement and two stories at the present time with adequate foundations for the addition of three stories later. When completed about April 1, 1917, there will be housed in the building a power sub-station, a large warehouse, a repair shop, supply depot and garage. With trackage in the rear, excellent facilities are provided for handling shipments of material. Construction is under the supervision of the engineering department of H. M. Byllesby & Company, with Wm. T. Walker in personal charge. The structure will cost approximately $250,000 not including additional stories to be added subsequently.

National Commercial Gas Association Sends Out New Application Blanks

The National Commercial Gas Association is sending out new membership application blanks in accordance with the amendment to the constitution passed at the Atlantic City Convention which established the following schedule of dues for company memberships:

Class A.—Companies serving less than 10,000 population..$10.00

Class B.—Companies serving from 10,000 to 25,000 population 15.00

Class C.—Companies serving from 25,000 to 50,000 population 25.00

Class D.—Companies serving over 50,000 population to pay 1/100 of one per cent of their gross annual receipts from the sale of gas for the subscribing company's last preceding fiscal year. The minimum dues from any such company to be $50.00, and the maximum dues from any such company to be $500.00.

Class E.—Foreign Companies 25.00

Class F.—Manufacturing Companies 25.00

Class G.—Holding Companies.

Any one or more of the subsidiary gas or combination gas and electric companies of a holding company may be enrolled separately as members of the Association upon payment of annual dues for each company so enrolled according to our schedule based upon population served. If, however, a holding company and all of its subsidiary gas and combination companies are enrolled, the aggregate of the annual dues, which shall be paid by the holding company, shall not exceed $750.00.

Old Colony Gas Company Celebrates Fifth Anniversary at Weymouth, Mass.

The Boards of Trade from the six towns in the Old Colony district gathered December 18, as the guests of President E. M. Farnsworth, of the Old Colony Gas Company in Weymouth, Mass., to inspect the gas plant and to see what has been accomplished in the relatively short time of organization.

An excellent dinner was served and on the back of the very attractive menu was the accompanying photo finished in sepia.

Five years ago the officials of the towns of Braintree, Weymouth, Rockland, Abington and Whitman gathered at the East Braintree works of the Old Colony Gas Company and President Farnsworth opened the valve which turned gas into the fifty-two miles of mains supplying the five towns.

Since then, over five thousand homes have been supplied. Hingham, too, has been added to the system and the network of mains has been extended until it now covers over one hundred and thirty miles.

The plant to-day stands as a wonderful monument to its sponsor, E. M. Farnsworth, and its designing and constructing engineer, J. D. Shattuck, of Philadelphia. It is one of the best equipped and most modern works and distribution systems in the country.

Merger Planned for Memphis, Tenn., Companies

Legal consolidation of the Merchants Power and Memphis Consolidated Gas & Electric Companies, provided for under the compromise agreement reached with them by the city, will take place shortly after the new year, when the ordinance permitting the consolidation becomes effective.

Just what form the consolidation will take, which company will take over the other, or whether a third will be formed to absorb the individual companies, has not yet been worked out.

Following the legal consolidation of the companies, there will be a merger of the two office forces. Each of the companies now has a separate office building.

Considerably more improvements and extension work will be accomplished in 1917 than has been done in 1916.

Gas Companies Generous with Bonuses and Wages

A 10 per cent bonus on monthly wages, effective on Dec. 1 and Jan. 1, is the Christmas present of the Milwaukee Coke & Gas Company and the Newport Chemical Works to 1,200 employees. The bonus applies to laborers and office employees alike.

"This rate of wage will continue as long as conditions warrant," said J. W. Shaeffer, general manager. "All employees will share and share alike on the basis of their monthly wage."

The Milwaukee Coke & Gas Company and the Newport Chemical Works operate on the basis of the eight hour day. The Newport Chemical Works is a subsidiary organization of the Milwaukee Coke & Gas Company and is located in Carrollville.

The Cambridge, Mass., Gaslight Company has notified all its employees who now receive not more than $2,000 per year that the directors had voted to increase their salaries 10 per cent until

further notice. This follows the action of the Boston Woven Hose & Rubber Company, which increased the wages of its factory employees the same amount.

War time prosperity, resulting from the sale of coal tar by-products, has enabled the Laclede Gas Light Company of St. Louis, Mo., to distribute $100,000 among its 1,650 employees. It also divided $1,070,000 among its common stockholders in the form of a 10 per cent dividend in addition to the regular annual dividend of 7 per cent.

Industrial Rates Raised in West Virginia

Industrial gas rates in Huntington and Barboursville, W. Va., and domestic and industrial rates at Kenova and Ceredo will be advanced on January 1 by the United Fuel & Gas Company, an order permitting such an increase having been entered by the public service commission at Charleston. The basic rate for domestic gas as furnished by this company at Ceredo and Kenova is to be twenty cents per thousand feet instead of fifteen cents as at present, while the manufacturing rate in the four municipalities has jumped from an eight to a ten cent minimum. The petition did not seek to alter domestic rates in Huntington and Barboursville, for which the minimum rate will continue to be fifteen cents.

Quarter Meter Users to Pay Extra at Waukegan, Ill.

Formal acknowledgement of the new rates of the North Shore Gas Company as they apply to Waukegan, has been received by Mayor W. W. Pearce, from the Illinois Public Utilities Commission, which fixes the rates at $1 for the first 1,000 feet and 90 cents for the next 10,000 feet used in a month.

According to the statement, homes which are equipped with the prepayment meters, will not be permitted to indulge in the 90 cent rate if more than 1,000 feet is used. It merely states in the list of rates that the consumer using a prepayment meter must pay $1 a thousand feet.

This, however, is a decrease in price as the users of that form of meters in the past have been forced to pay $1 for each 1,000 feet of gas used.

The rates are entirely acceptable to the commission, according to the statements of Commissioner Walter B. Shaw, chairman of the commission. The new rates will go into affect in Waukegan, January 1.

Two More Pennsylvania Towns Have Gas

Annville and Palmyra, Pa., are now being supplied with gas by the Lebanon Gas & Fuel Company, operated by Henry L. Doherty & Co. The final work on the pipe-line to these towns was recently completed. The supply of these communities means about a 40% addition to the Lebanon Company's send-out.

"Safety First"

A. J. Van Brunt, director of the Safety Education Bureau of the Public Service, gave an interesting talk recently to the employees of the company at the Sip Avenue Building, Jersey City, N. J. Mr. Van Brunt talked on this oft repeated subject in a new way. Figures for the year 1915 as shown by the speaker clearly illustrated the need of the subject of safety being put before the minds of all classes of people both young and old. For some unknown reason the number of accidents in the past year and a half have increased enormously all over the country, in the home, on the street and in the work-shop. One of the reasons given is that the people in this country have been imbibed with the spirit now so prevalent in Europe, the spirit of "it doesn't matter" or "I don't care." This spirit is going on at a greatly increased rate in the daily work of the office, mill and shop, causing accidents that result in serious injuries and death to the worker and untold suffering and hardship to his family. The speaker urged that a new leaf be turned over and the true spirit of loyalty to the employer be linked with carefulness and safety. New series of motion pictures were released and proved to be very instructive and interesting.

Mr. Van Brunt has spoken to about 500,000 school children and 52,000 teachers throughout the state, preaching his gospel of "Safety First."

Mr. G. E. Smith, who had charge of the meeting, made a brief speech of introduction. He pictured the time when the Safety First movement was only a joke and how through the efforts of such men as Mr. Van Brunt had become one of the great worthwhile movements all over the country.

Public Service Saving Society of Hoboken

This society was formed in January of 1916 by the employees of the Hoboken office for the purpose of encouraging thrift among them and also to enable each employee to have a sum of money for use around the holidays, when it is perhaps more desirable than at any other season.

The membership extends to the Distribution Department and numbers about 65 employees who have saved over $1,300.00, which was distributed before Dec. 15.

F. W. Schmidt, division agent, and E. V. Walsh, agent, are enthusiastic members of this society and contribute regularly to the fund.

According to the last reports it was planned to have a supper for all of the members at the time of distribution, the expense of which was to be defrayed by the interest received on the money deposited and the fines imposed on those forgetful members who skipped weekly payments.

Contract for Purchase of Gas in Boston Disapproved

The Massachusetts Gas & Electric Light Commission has disapproved of a contract entered into Nov. 7, 1916, between the Boston Consolidated Gas Company and the New England Gas & Coke Company, by which the former would purchase of the latter gas for a period of three years.

The commission finds, after public hearing that the price named in the contract, 34.5 cents per 1,000 cu. ft. is not less than it would cost the Consolidated Company to make its gas "in works of standard type, properly equipped, suitably situated and of sufficient capacity to make all the gas required by the whole district supplied."

Want Law Changed so Material Other Than Leather May Be Used for Binding Court Reports

The matter of conserving the leather supply for uses for which no substitute can be applied has become of especial importance during recent months. For some purposes where leather is still used, there are, it is said, substitutes available which serve as well, and, in some cases, even better. A recent striking illustration of the acute situation in regard to the leather supply is the action of A. A. Lilly, attorney general of West Virginia, who has announced that he will ask the legislature to use a substitute material for binding the 5,000 volumes of the Reports of the quires to be bound in leather. This action is due to the scarcity Supreme Court of Appeals of West Virginia, which the law re- of the latter material.

Ask that Gas Companies be Given Precedence in Furnishing Cars for Coal Deliveries

The Michigan Gas Association is making a strong effort towards having preference given public utility companies upon which the public is depending for domestic fuel, heating and lighting, in the allotment of cars for hauling fuel. At a recent hearing, which was attended by over a hundred men representing shippers, railway companies, business men and private citizens, the Michigan Railroad Commission sought to arrive at some means by which the coal shortage situation in that state might be relieved. This hearing was attended by the secretary of the gas association at the suggestion of its president, and, as a result, the following communication was prepared and sent to the state commission:

"As the time was well taken up at the hearing on important matters I realized it was impossible to give everybody an opportunity to be heard. I am therefore taking this opportunity of presenting to you the serious situation facing many gas companies throughout the state of Michigan. As secretary and treasurer of the Michigan Gas Association, I was sent to the hearing to make an appeal to your commission, that you might understand the seriousness of the situation in which public service corporations are placed, especially gas companies. Almost the entire public is depending upon the gas companies for cooking, and a great share for heating and lighting. Over 75 per cent of the gas companies of the state of Michigan are in serious shape on coal shortage. It is realized, of course, they have to run regardless of

conditions, and they cannot go into the open market and pay high prices for coal when they are duty bound to sell their product under franchise requirements controlling the retail price.

"Another matter which undoubtedly bears greatly on the high price of fuel is the fact that gas coke in the state of Michigan is exhausted. I know of no company that has a pound of coke for sale at the present time. This is due especially to the shortage of coal and the low price of coke, and now all the coke that is made is used to replace coal under boilers and retorts and in the manufacture of water gas.

"If coal could be supplied to public service corporations it would mean thousands of tons of coke for domestic use which might bring down the price of coal.

"Therefore, the Michigan Gas Association asks the Michigan Railroad Commission to take the matter up with the Interstate Commerce Commission to instruct railroads to give gas companies and other public service corporations whose operation directly affect the welfare of the public, precedence in furnishing them cars for both loading and delivery of fuel. Appreciating any efforts you can set forth."

It is recommended that the respective members should write individually in furtherance of this request.

Geyser of Flame Signals Triumph for Cheap Industrial Fuel

Muskogee, Okla., recently celebrated the completion of a pipe-line which will bring industrial gas to Muskogee at 4 cents per 1,000 cu. ft.

In the early evening the Mayor, J. E. Wyand and several prominent citizens gathered while City Engineer H. H. White opened a valve in the pipe-line and lighted a four-inch pipe-torch that extended twenty feet into the air.

For blocks around the burning gas shed a light that dimmed the moon. When the valve was first opened the gas rushed out with a pressure of 150 pounds. This caused the flame to burn several feet above the end of the torch, however, and the pressure was cut almost in half, making a bigger and redder flame.

With approximately three miles of line yet to be laid from the fair grounds through the heart of the city, the entire job is within two weeks of completion if the weather continues favorable, the engineer estimates. The actual construction of the pipe-line has been done thus far at a cost little in excess of $10,000. There is $28,000 yet unspent of the $100,000 worth of bonds sold, Mayor Wyand declared, and the prospects are that at least $20,000 will be left when the entire job is completed.

Want Commission to Manage Works at Holyoke, Mass.

Labor leaders at Holyoke, Mass., are considering the question of having a bill drawn up and submitted to the State Legislature next year to abolish the office of manager of the Holyoke Municipal Gas & Electric Departments and the creation of a gas commission to take over the management. Labor men explain that they had been talking over the matter and they had outlined the proposed bill in a general way. Their idea is to have a commission of three members to be elected by the people and not appointed by the mayor or elected by the board of aldermen.

Company Offers to Sell Plant to City

The Southern Gas Improvement Company has made Elizabeth City, N. J., a rather attractive offer in an effort to sell the gas plant to the city. It is perfectly willing to submit a valuation of its property by competent engineers and to abide by a price so fixed. The company values its land, buildings, machinery, mains, pipes, meters, lamps and stock on hand at $58,000 to $75,000. At least that is what they claim to have put into the property since they located here three years ago.

The gas company sold nine million feet of gas last year; it expects to sell ten and a half million feet next year; if the city used gas for street lighting, it is estimated next year's output would not be less than 15 million feet. It costs 85 to 90 cents per 1,000 ft. to make 10 million feet of gas; it will cost 75 cents to make 15 million feet of gas. This would give the city the long end of it.

The gas company also points out that the city is able to buy a gas plant with which to light its streets, but is hardly able to indulge in the greater luxury of an electric light plant at the price of $400,000 or more indicated by the owners of the Elizabeth City Electric Light & Power Company.

New Company to Control Greenville, Miss., Gas Plant

A charter has been granted to the Greenville Gas Company which will take over the property of the Greenville Gas & Coke Company and the new company expects to make such improvements as are necessary to bring the plant to the modern standard.

Fred A. Tippy of Greenville, Miss., will be the manager in charge.

The new company has not been and is not now in control of the old plant here, but has secured the offices where the business will be carried on when the new company takes charge, probably in January.

In the meantime the business of the old company will be wound up at the old Greenville Gas & Coke Company's office, the charter of the old company having been secured in South Dakota.

Commission Upholds Industrial Gas Increase

Increase of the Potter Gas Company's minimum rate from fifty cents to a dollar for furnishing natural gas in its field is upheld by the Public Service Commission of Penn., because of the conditions prevailing in the natural gas business in an opinion handed down to-day by Commissioner M. J. Brecht, dismissing complaint made by the citizens of Galeton, against the company's rates.

"The actual increase in the price of natural gas and the upward tendency of the market for the product in the fields of the Potter Gas Company, would appear to furnish substantial grounds under the evidence submitted to the commission to justify the respondent to increase the amount of its gross income," writes Mr. Brecht, who also remarks that that sort of gas to the company has been advancing and that within three years it has increased twenty-five per cent. In addition he notes that the company has not paid a dividend since 1908.

The opinion also declines to change the form of contract.

Societies and Associations

The New York Section of the Gas Meeters recently accepted the invitation of the Peter Doelger Brewing Company of New York, to inspect their model plant. Approximately 150 gas men went through the plant from top to bottom where every part of the process was explained. Music, refreshments and some very interesting entertainment was supplied by the Peter Doelger's reception committee, and the entertainment committee of the Gas Meeters. A recent interview with G. E. Smith, Grand Secretary and Treasurer of the Gas Meeters, brought out several of the future activities which are planned for the New York, Philadelphia and Cleveland sections, especially the New York Section. Mr. Smith's keen interest, in conjunction with C. E. Bartlett, Grand Commissioner, who is connected with the Ruud Manufacturing Company of Phila., has assured a masquerade ball and a beefsteak dinner for a beginning of the activities of the New Year.

The Industrial and Commercial Employees Association of the Public Service Corporation, Jersey City division, recently held an entertainment and dance in the auditorium of the Public Service building, 84 Sip Avenue, Jersey City, N. J. A. R. Lewis, president pro tem of the Association, made a few introductory remarks and extended the best wishes of the holiday season to those present. Several musical selections and recitations were heard, these were then followed by a dance.

THE NEW YORK SECTION OF THE ILLUMINATING ENGINEERING SOCIETY, held their usual monthly meeting at the Engineering Building, 29 West 39th Street, Dec. 14, following an inspection of the new artificial lighting installation for the illumination of the Statue of Liberty, on Bedloe's Island, and an informal dinner at the Forty-Second Street Restaurant. An interesting paper entitled "What the Theatre Expects from the Lighting Engineer," was read by T. C. Browne, and a lecture was given by H. H. Madgsick, on "Lighting Liberty." The paper by Mr. Browne which covered the most modern lighting systems employed in the European theatres, notably those at Dresden, Charlottenburg and Berlin, was followed by a most interesting discussion, pointing out a new field of activity for the Illuminating Engineer—a field of a very practical nature—that of providing suitable lighting equipment for the various color effects desired in the modern theatre. The discussion on the paper by Mr. Madgsick, by men who collaborated in the design and installation of the lighting equipment on Bedloe's Island, brought to the attention of the members some of the difficulties encountered in this truly monumental undertaking.

Personal Notes

EMIL A. BECHSTEIN, former manager has now been elected second vice-president of the Sandusky (Ohio) Gas & Electric Company, to succeed P. A. Staples. Mr. Bechstein is also president of the Ohio Electric Light Association.

J. WEAVER SMITH, formerly with the Atlanta (Ga.) Gas Light Company, and later illumination specialist for the Nashville (Tenn.) Gas & Heating Co., has assumed his new duties as commercial agent of the Elkhart Gas & Fuel Company, Elkhart, Indiana.

P. A. STAPLES, formerly vice-president and general manager of the New Jersey Power & Light Company, Dover, N. J., and second vice-president of the Sandusky Gas & Electric Company, has been elected vice-president and general manager of the Binghamton (N. Y.) Light, Heat & Power Company, succeeding S. H. Dailey who has been made general manager of the public utilities operating in Lexington, Ky.

R. B. MARCHANT, treasurer of the J. G. White & Company, Inc., N. Y., was elected to the office of vice-president at a recent meeting of the board of directors.

LIVINGSTON CUSHING, a director of the Woburn Gas Light Company, Mass., died of heart trouble Nov. 25. He was hurrying for a trolley in New Haven on his way to the Harvard-Yale football game when stricken.

THE SHIELDS OIL GAS COMPANY, of Madison, W. Va., has recently been reorganized, and an entirely new set of officers elected. President, F. P. Murphy, vice president and general manager, A. S. Hutson, secretary and treasurer, W. B. Wade, all of Madison, W. Va.

Construction Notes

Work on Gretna (La.) Plant to Begin Jan. 1

The new corporation, the Gretna Gas Light & Fuel Company, which is now laying its mains in Gretna, expects to start work on the plant itself about Jan. 1.

The Gretna plant will have a capacity of 10,000 cubic feet per hour and the Tenney process of manufacturing gas will be installed in the plant which will be a model in every respect.

The company officials are exercising unusual care in the installation of the two-inch pipe. Instructions have been given the contractors to lay the pipes in streets that are to be shelled in the near future. This will prevent tearing up the streets after the surface improvements have been made. The service mains are being laid to preclude the possibility of future trouble and at each three hundred feet a mercury air pump test is made.

Brockton Company to Enter Canton

Differences between the Brockton (Mass.) Gas Light Company and the town officials of Canton, in which the company sought a franchise to do business, have been composed, and the contract will soon be signed. The initial construction outlay will be about $75,000. The sliding scale of prices agreed upon fixes the price at $1.45 per 1,000 cu. ft. the first two years, and a reduction of 5 cents every two years thereafter, providing the rate is always 20 cents per 1,000 ft. higher than in the city of Brockton. It is expected that by the progressive reductions, $1.00 gas will be a fact within 18 years. Construction will be begun in the spring.

Oil Tank for Northampton, Mass.

The Northampton Gas Light Company has petitioned the city council for permission to erect an iron oil tank to be 25 feet, 3 inches diameter and 19 feet, 5½ inches high, to be made conical in shape of heavy boiler iron for the purpose of storing gas oil for gas manufacturing purposes only. To be located on the south westerly corner of the gas company's property, bounded on the west by the Smith & Jones block, on the south by the New York, New Haven & Hartford Railroad and to be located not nearer than 50 feet from Smith & Jones block.

Mains to be Laid in Fairport, N. Y., by February

The work has begun on the excavations in Fairport, N. Y., for the gas system to be installed by the Despatch Heat, Light & Power Company. The company has obtained a special franchise from the state, town and village to operate in Fairport and as soon as the necessary formalities were completed began work in West Church Street, near the west edge of the village, where the lines will connect with those already laid in East Avenue Road, which connects with the company's plant in Rochester.

It is said that the work will be so far completed that in all probability gas may be furnished early in February.

Pipe Contract Awarded at Hamilton, O.

The Scioto Valley Supply Company of Columbus, O., was the lowest bidder on the gas pipe and fitting for the gas department at Hamilton, O., the bid being $1,653.13.

Jenkintown, Pa., to Have New Gas Building

The contract for a two-story, 36 x 60 ft. stone office building, to be erected at Jenkintown, Pa., has been awarded to John Stevens. This building will be occupied by the Suburban Gas & Electric Company. Lawrence V. Boyd, architect.

Pawtucket, R. I., Company has Completed its Work on Blackstone River Bridge

Pawtucket Gas Company employees have completed the work of connecting the gas mains at the new Whipple bridge, spanning the Blackstone river at Lonsdale. The driveway is being rolled by a steam roller and as soon as some grading work on the Lincoln side of the bridge is completed the structure will be opened for traffic. The bridge is being built by the McKinnon Construction Company under the direction of the state board of roads.

Recent Patent Issues

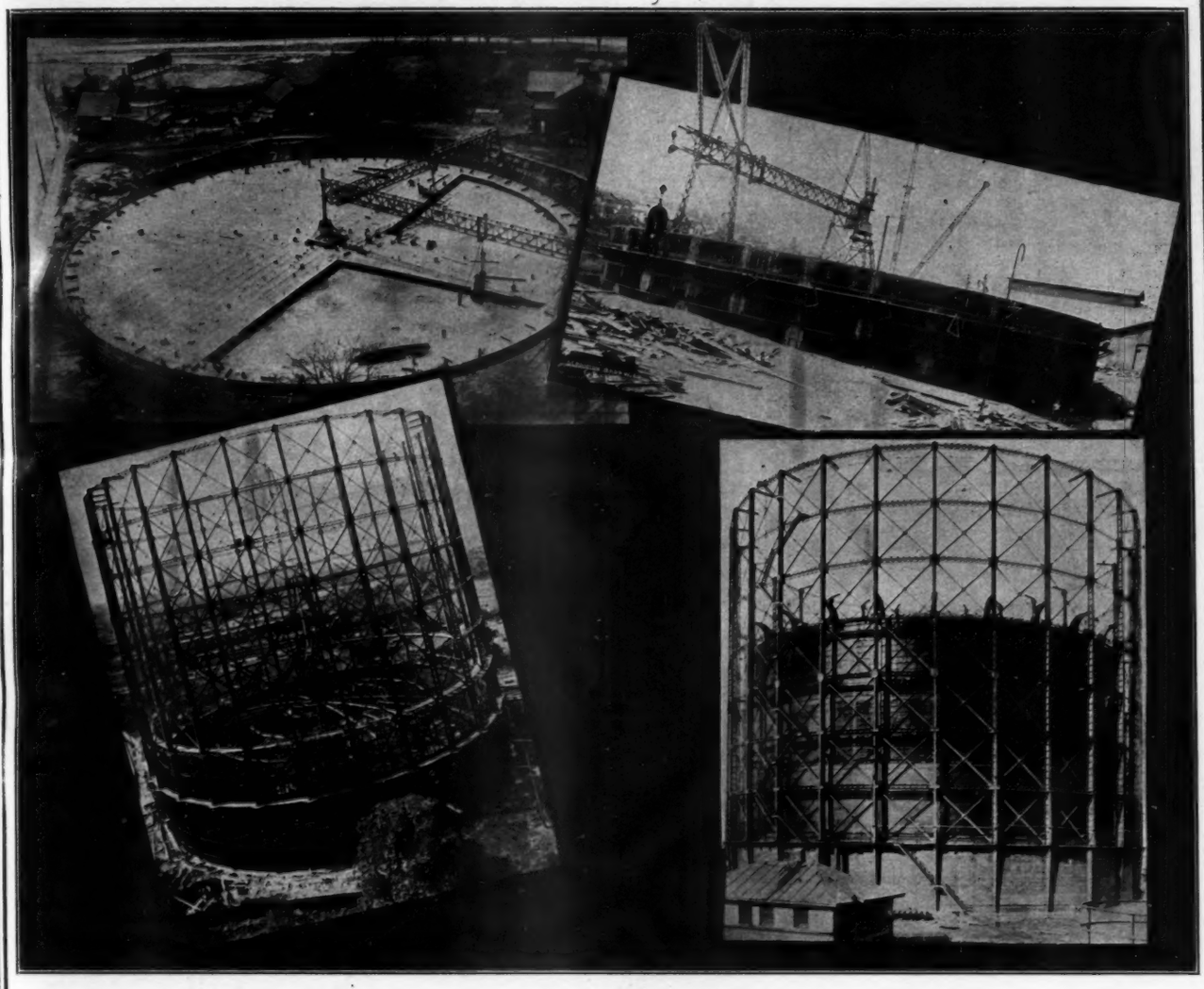
Prepared by Royal E. Burnham, 833 Bond Building, Washington, D.C.

1,207,135. AUTOMATIC GAS-VALVE. Sylvester J. Chism, Krum, Tex., assignor of one-half to Lawson M. Hayes, Slidell, Tex.

1,207,723. METHOD OF CARBONIZING FUEL. Henry L. Doherty, New York, N. Y.

1,207,724. METHOD OF MAKING COMBUSTIBLE GAS. Henry L. Doherty, New York, N. Y.

1,208,689. GAS-PRODUCER. John Stewart, Codnor Park, Alfredton, England, and William Stewart, Motherwell, Scotland.



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Financial Notes.

THE FAYETTE COUNTY GAS COMPANY has declared the usual monthly dividend at the rate of 8 per cent a year, payable Nov. 20 to stockholders of record Nov. 15.
Checks will be mailed.

THE NORTHERN OHIO TRACTION & LIGHT COMPANY has declared a regular quarterly dividend of 1¼ per cent on common, payable Dec. 15 to stock of record Nov. 25.

THE NEW BEDFORD GAS & EDISON LIGHT COMPANY has been authorized by the Massachusetts gas & electric commission to issue 3,180 shares, $100 par, at $225, to cancel obligations incurred in construction.

THE CONSUMERS GAS COMPANY OF TORONTO reports for the year ended Sept. 30 last, as follows: Total receipts, $3,637,805; expenses, $2,718,329; balance, $919,576; interest, $50,998; balance, $868,579; dividends, $488,200; balance, $380,378; reserve funds, $97,792; surplus, $478,170. The surplus of $478,170 has been transferred from profit and loss for the plant and building renewal fund. The balance sheet as of Dec. 30 last shows cash in bank and offices $128,335 and total assets and liabilities of $11,001,790.

THE NORTH SHORE GAS COMPANY'S earning statement shows gross for the twelve months ended Oct. 31, $365,151, net $186,567, an increase of about 11 per cent on gross and 18 in net over the last report previously made public—that of the year ended June 30, 1915. Interest on the first mortgage bonds evidently was earned a little more than twice. It is stated that there is now an over-the-counter market for these bonds at 95½ bid, 97 asked.

THE UNITED FUEL GAS COMPANY, a subsidiary of the Columbia Gas & Electric Company, in its advance statement of earnings for November, 1916, shows gross of $551,534, compared with gross of $307,975 for November, 1915, a gain of $243,559, or 79 per cent.

THE AMERICAN GAS & ELECTRIC COMPANY has declared an extra dividend of 2 per cent in common stock on the common stock, and usual quarterly cash, 2½ per cent, payable Jan. 2, to holders of record Dec. 18. Also quarterly 1½ per cent preferred, payable Feb. 1, to holders of record Jan. 18.

THE NORTHERN STATES POWER COMPANY OF DELAWARE has declared a quarterly dividend of 1 per cent, preferred, and 1¾ per cent, common, an increase of ¼ per cent. Preferred is payable Jan. 15 and common Jan. 20. Both to stockholders of record Dec. 30.

THE EMPIRE GAS & FUEL COMPANY reports, for the six months ended Oct. 31 last, as follows:

Gross earnings	$4,880,183
Operating expenses, taxes, etc	2,007,463
Net profits	2,802,720
Less earnings on stocks of subsidiaries not owned	115,169
Net accuring to Empire Gas & Fuel Company	2,687,551
Less six months' interest on first mortgage and collateral trust 6s	420,000
Balance	$2,267,550

THE WESTERN STATES GAS & ELECTRIC COMPANY reports earnings, for the years ended Oct. 31, 1945 and 1916, are as follows:

	1915.	1916.
Gross earnings	$1,175,780	$1,226,642
Net earnings	581,752	586,933

As compared with the net earnings for the year ended Oct. 31, 1913, there is an increase of more than 17 per cent in the 1916 earnings. The 1916 net is equivalent to more than twice all interest charges on bonds and notes of the company.

THE NATIONAL GAS, ELECTRIC LIGHT & POWER COMPANY has declared the usual quarterly dividend of 1 per cent on the common and 1½ per cent on the preferred stocks, payable Jan. 1.

THE CAROLINA POWER & LIGHT COMPANY has declared an initial dividend of ½ of 1 per cent on common, payable Feb. 1, to stock of record Jan. 16, and regular quarterly dividend of 1¾ per cent on preferred, payable Jan. 2, to stock of record Dec. 16.

THE DETROIT EDISON COMPANY reports, for all constituent companies for November gross $993,087, against $764,228; net $304,650, against $218,673. For eleven months ended with November, gross was $8,954,352, against $6,878,075; net $2,324,198, against $1,538,266.

THE MASSILLON GAS & ELECTRIC COMPANY has received contract for street lighting of Massillon for ten years. The new contract will mean an annual revenue of $21,300, an increase of $6,500 a year over the old contract.

THE OHIO CITIES GAS COMPANY has sold to Guaranty Trust Company, $5,000,000 6 per cent serial notes, dated Jan. 1, 1917, and maturing in one, two, three and four years. Stockholders of record will be permitted to subscribe to $1,000,000 new common stock, $25 par, at $85 a share in ratio of one share of new for each eight shares now held.

THE WEST ST. LOUIS WATER & LIGHT COMPANY reports for three months ended with October gross $69,692, against $53,882; surplus $27,664, against $12,856.

THE WISCONSIN-EDISON COMPANY has declared a regular dividend of $1.75 a share and extra dividend of 75 cents a share, payable Dec. 30, to stock of record Dec. 15.

Current Prices of Public Utility Securities

	Bid	Asked
Adirondack Elec. P	24	26
Adirondack Elec. P. pf	84	86
American Gas	120	123
*American Gas & Electric	145	150
*American Gas & Electric pf	50	52
American Light & Traction	375	380
American Light & Traction pf	111	113½
American Power & Light	79	81
American Power & Light pf	86½	88
American Public Utilities	40	44
American Public Utilities pf	71	74
American Water W. & Elec	11½	13½
Amer. W. W. & E. 1st pf	70	74
Amer. W. W. & E. Part'p pf	26	29
Carolina Pow. & Lt	35	38
Carolina Pow. & Lt. pf	98	102
Cities Service	320	323
Cities Service pf	92	94
Colorado Power	31	33
Colorado Power pf	100	104
Commonwealth, Pr. Ry. & Lt	59	61
Commonwealth, Pr. Ry. & Lt. pf	83	85
Electric Bond & Share pf	100	102
Empire District El. pf	90	95
Federal Light & Traction	15	18
Federal Light & Traction pf	55	58
Gas & Electric Securities	300	325
Gas & Electric Securities pf	95	100
Northern States Power	106	109
Northern States Power pf	99½	101
North. Ont. Lt. & P	14	17
North. Ont. Lt. & P. pf	59	64
Ozark Power & Water	44	48
Pacific Gas & Electric	64	66
Pacific Gas & Electric pf	91	92½
Republic Ry. & Light Co	50	52
Republic Ry. & Lt. Co. pf	74	77
*Standard Gas & Electric	15	16
*Standard Gas & Electric pf	41½	42½
So. Cal. Edison	94	96
So. Cal. Edison pf	106	109
Tennessee Ry., Light & Power	10	11
Tennessee Ry., Light & Power pf	44	48
United Light & Railways	48	50
United Light & Railways 1st pf	76	78
Western Power	19½	21½
Western Power pf	68	71

*Par value $50

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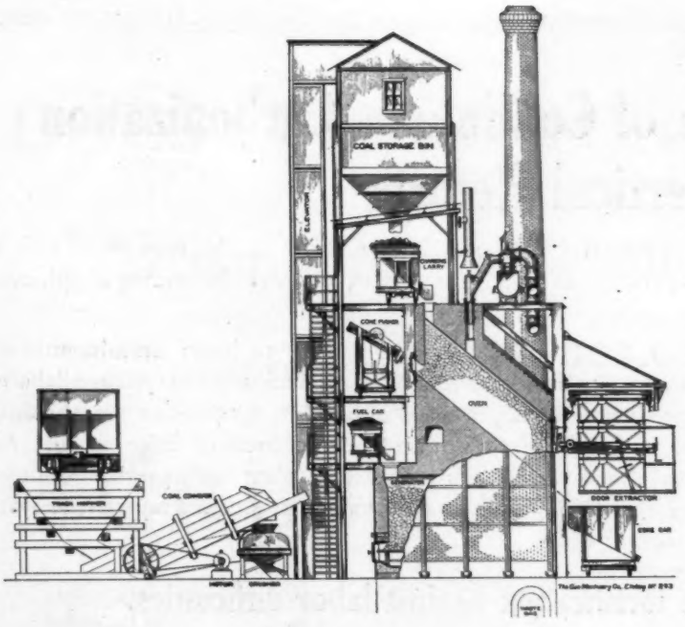

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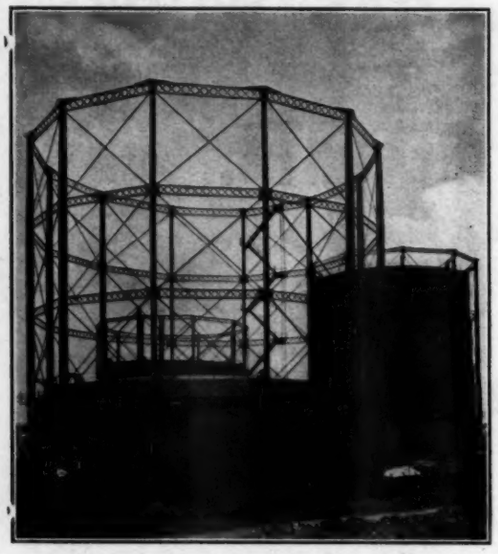

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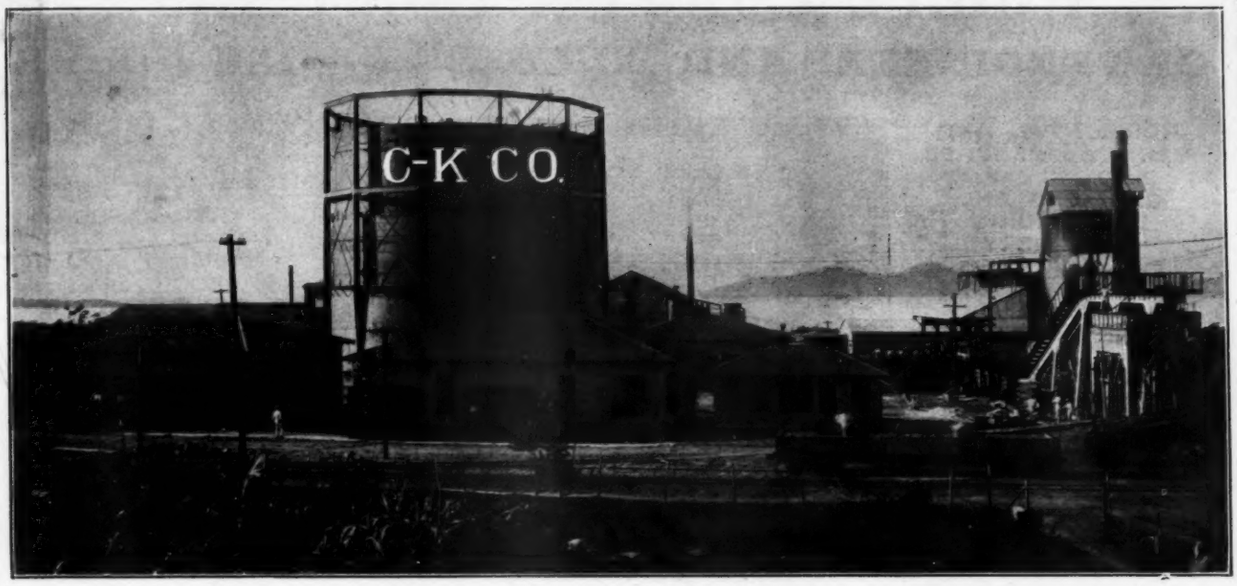

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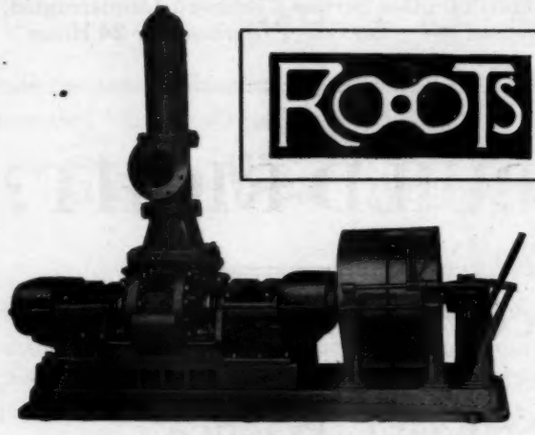

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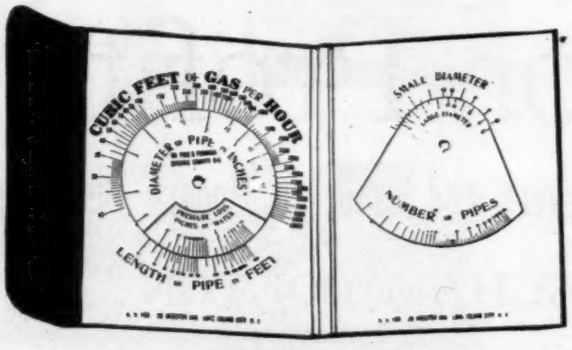

Fox Gas Flow Computer

For Superintendents, Salesmen, Foremen and Fitters

TO DETERMINE THE PROPER SIZE OF PIPE TO SPECIFY OR INSTALL AS RUNNING LINES, SERVICES, AND FOR CONNECTIONS TO APPLIANCES AND METERS.

The "Gas Flow" Computer on the left of the folder has the following ranges:

Cu. ft. of gas per hour, from 10 to 10,000 cu. ft. Length of pipe, ... from 10 to 1,000 feet.
Diameter of pipe, ... from ⅜ to 6 inches. Pressure loss, ... from 0.01 to 1 in. water.
Specific Gravity—0.6.

The Computer on right of the folder affords a rapid means of determining the number of pipes that can be taken from one of a larger diameter, and have an equivalent capacity. It also can be used to determine the size of pipe necessary to supply a number of small pipes of the same, or varied diameters. It may be used to design headers for meters and appliances, when the distances between the outlets are small enough to make the loss of pressure negligible.

The Computer is issued in pocket size, mounted in a neatly bound folder, measuring 4½ inches by 6 inches, containing an insert page of directions.

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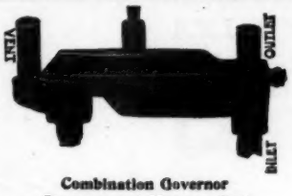

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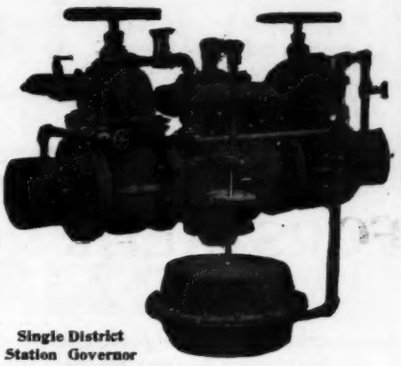
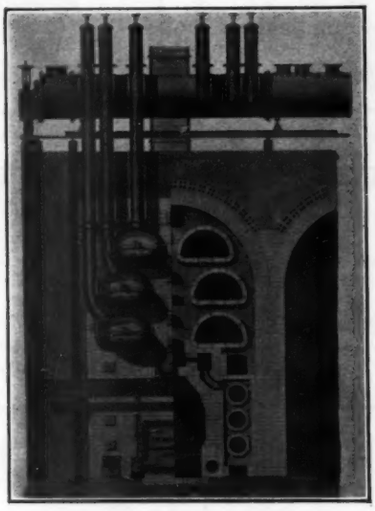


Single District
Station Governor

Gas Benches

GREATEST ECONOMY



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We can save money, time and tools for you.

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No Work Too Special
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The paramount note that every gas man should demand in OXIDE. Iron Hydroxide is a pledge of quality, backed by a guarantee of ten years' honest business.

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WHO DOESN'T LIKE A GOOD SONG!

The Sweetest Singers in the Land are our Happy Steam Hydraulickers.

Here is there Orphean lay, hot, right off the Grammar!

"More! More! We'll 'Hook 'er' some More; Out with the Things which have Stung us so Sore!

The Breaking-Down Things,

The Losing-Juice Things,
The Confounded,
On-the-Bum,
What's the use Things.

"More! More! We'll 'Hook 'er' some More; We've took our last Stung and we've swore our last Swore."

If you'd like to see some of the choir (All-Collegiate) here they are:

International Harvester Co.—Biggest agricultural works—Got one and sings for more.
United Gas Imp. Co.—Biggest in utilities—Got one and sings for more.
Remington Arms & Am. Co.—Biggest in guns—Got one and sings for more.
Remington Typewriter Co.—Biggest in typewriters—Got one and sings for more.
John Morrell & Co.—Biggest in packers—Got one and sings for more.
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U. S. Rubber—Biggest in tires, etc.—Got one and sings for more.
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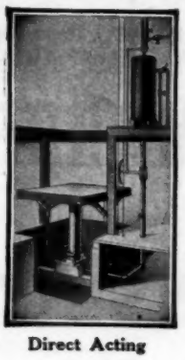
Standard Oil Co.—Biggest in oils—Got one and sings for more.
Packard Motor Car Co.—Biggest in best autos—Got one and sings for more.
Cluett, Peabody & Co.—Biggest in collars—Got one and sings for more.
D. B. Martin & Co.—Biggest in packers—Got one and sings for more.
E. I. DuPont & Co.—Biggest in powder—Got one and sings for more.
Midvale Steel Co.—Biggest in plates—Got one and sings for more.
Merrimac Chem. Co.—Biggest in chemicals—Got one and sings for more.
Barrett Mfg. Co.—Biggest in coal tars—Got one and sings "More."
Consolidated Gas Co.—Biggest in gas—Got one and sings "More."
Procter & Gamble—Biggest in soaps—Got one and sings "More."
American Hard Rub.—Biggest in hard rubber—Got one and sings "More."
Continental Gin Co.—Biggest in cotton gins—Got one and sings "More."
Marathon Paper Co.—Biggest in paper—Got one and sings "More."
Sears Roebuck & Co.—Biggest in mail orders—Got one and sings "More."
American Tobacco Co.—Biggest in tobacco—Got one and sings "More."
Welsbach Light Co.—Biggest in mantles—Got one and sings "More."
Gen'l Elec. Co.—Biggest in electricity—Got one and sings "More."
Buffalo Bolt Co.—Biggest in bolts—Got one and sings "More."
Am. Smelt. & Refin. Co.—Biggest in metal—Got one and sings "More."
Buffalo Bolt Co.—Biggest in bolts—Got one and sings "More."
Std. Underground Cable Co.—Biggest in copper wire—Got one and sings "More."

And while all these (and 2000 more we might name if we had the space) are singing for "More" and "More" Ridgway Elevators. There you go Stinging your Employees with

"The breaking-down Things,
The losing-juice Things,
The confounded,
On-the-bum,
What's the use Things."

Wake up, "DEADIE"—come to life—get wise and find out what it means to

"Hook 'er to the Biler"



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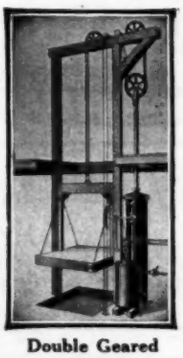
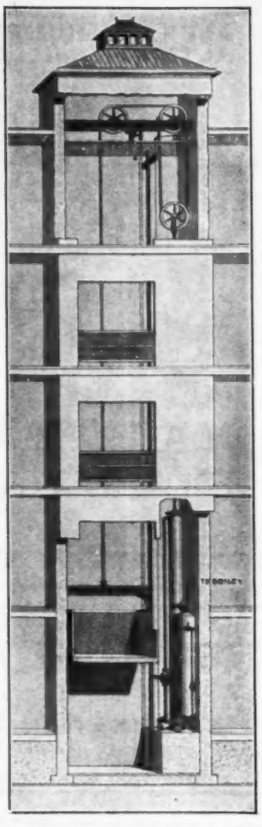


Double Geared



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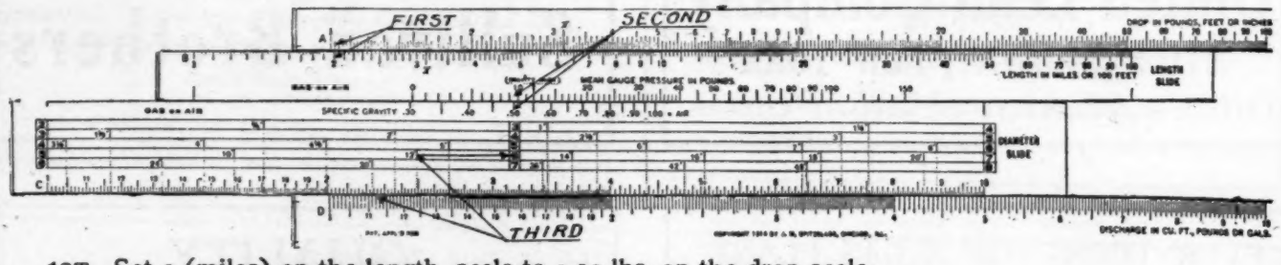
ELEVATOR MAKERS TO FOLKS WHO KNOW.

A PROBLEM IN HIGH PRESSURE GAS DISTRIBUTION
Solved by the Spitzglass Slide Rule and Flow Computer

EXAMPLE (Copied from Am. Gas Light Journal, Jan. 25, 1915, p. 51); Find size of pipe to deliver 112,295 cubic feet of natural gas, specific gravity 0.50, with a drop of 1 02 lbs. over a length of 2 miles, initial pressure being 10 lbs. gauge. Referring to the figure—



1ST. Set 2 (miles) on the length, scale to 1.02 lbs. on the drop scale.

2ND. Set 0.50 specific gravity to 9.5 mean gauge pressure (mean pressure being—initial plus final—divided by 2).

3RD. Opposite the number 1.123 read the nearest larger diameter 12″ in the horizontal row marked 6 (number of integers in the quantity 112,295) in the middle heavy type column. The answer is, therefore, 12″ pipe.

THREE FEATURES COMBINED

1. **Solves quickly and simply all problems involving the flow of gas and all other fluids in pipes.**
2. **The results are more accurate than those obtained by other formulas, because the rule is based on new experimental data.**
3. **Accomplishes all ordinary slide rule calculations.**

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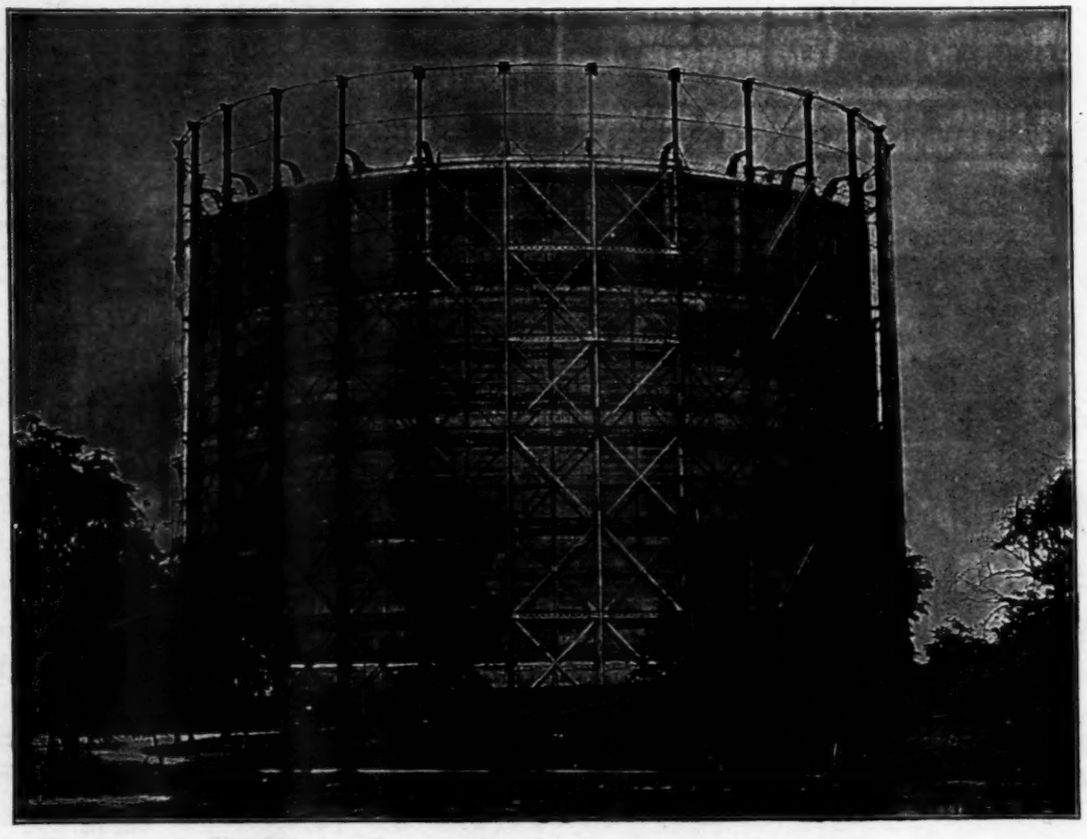

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12-25-3

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12-25-1

FINANCIAL NOTICES.

Office of the United Gas Improvement Co.

N. W. Corner Broad and Arch Streets.

Philadelphia, Dec. 13, 1916.

The Directors have this day declared a quarterly dividend of two per cent. ($1.00 per share), payable Jan. 15, 1917, to stockholders of record at the close of business Dec. 30, 1916. Checks will be mailed.

I. W. MORRIS, Treasurer.

12-18-4

MISCELLANEOUS.

FOR SALE

200 No. 2 Philadelphia Lamp Posts. Springfield Gas Light Co., Springfield, Mass.

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NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 120 in use. Write to
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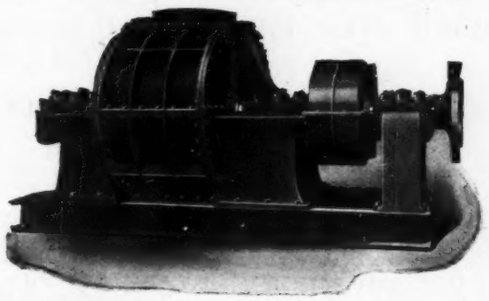

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The machine above illustrated is the latest improved type of the high pressure gas pump, and takes front rank in matters of efficiency and serviceability.

Note the six liberal size, ring-oiling bearings, heavy ribs and cylinder and headplates, the rational box-foot design, rigid 1-piece bed-plate, split cylinder and headplates, flexible coupling.

Write for further particulars and quotation stating desired capacity and pressure.

Ask for Catalog

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CONNERSVILLE, INDIANA.

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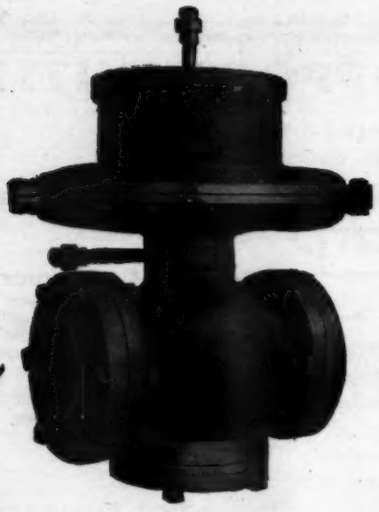

The FULTON

ILLUMINATING GOVERNOR

Is designed to reduce a medium pressure of 15 lbs. or less to a delivery pressure of a few inches of water or not to exceed 6 ounces.

Sizes run from 2 inches to 8 inches, but will make larger sizes if desired.

MAY BE USED AS A DISTRICT GOVERNOR OR FOR INDIVIDUAL SERVICE

REMEMBER—We have been making gas governors for over 30 years, and our engineering department is at the service of our customers, at all times.

Send for a copy of our illustrated catalog. It's interesting reading.

The Chaplin-Fulton Mfg. Co.

Pittsburgh, Penna.

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No. 262 Type D Unit.

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By jotting down facts and figures—a general outline of the gas street lighting situation in your community.

Send them to us in such form as may be most convenient to you. For our part, we will follow through with the best suggestions we can offer, to help you provide such excellent street lighting by gas that your people will be satisfied with none other. With proper equipment, properly maintained, gas for street lighting purposes is superior.

Write us about these things, before the notion gets away from you.

"The Largest Contractors for Gas Lighting in the World."

WELSBACH STREET LIGHTING COMPANY OF AMERICA

1934 Market Street, - Philadelphia, Pa.

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No. 162-C Type D Unit.

309

ASSOCIATION MEETINGS.

SOCIETY OF GAS LIGHTING.
Annual Meeting—New York City, December, 1917.
President, Fred S. Benson.
Secretary. George G. Ramsdell, 29 West 39th St., New York City.

NEW ENGLAND.
Annual Meeting—Boston, Mass., February, 1917.
President, H. C. Crafts, Pittsfield, Mass.
Secretary, N. W. Gifford, East Boston, Mass.

GUILD OF GAS MANAGERS.
Annual Meeting—Young's Hotel. Boston, Mass., March, 1917.
Monthly Meeting—Second Saturday.
President, S. J. Fowler
Secretary, H K. Morrison, Lynn, Mass.

WISCONSIN.
Annual Meeting—Milwaukee, March 15-16, 1917.
President, F. L. Cross, Madison, Wis.
Secretary-Treasurer, Henry Harman, Milwaukee, Wis.

ILLINOIS.
Annual Meeting Chicago, March 21 and 22, 1917.
President, C. W. Bradley, Chicago, Ills.
Sec'y-Treasurer, Horace H. Clark, 72 W. Adams St., Chicago, Ill.

SOUTHERN.
Annual Meeting—Roanoke, Va., April ———, 1917.
President, Rosco Nettles, Tampa, Fla.
Secretary-Treasurer, E. D. Brewer, 45 Poplar Circle, Atlanta, Ga.

PENNSYLVANIA.
Annual Meeting—Reading, Pa., April ———, 1917.
President, F. P. Duggan, Lewistown, Pa.
Secretary-Treasurer, L. R. Dutton, Wyncote, Pa.

NEW JERSEY.
Semi-Annual Meeting—
President, S. J. Franklin, Millville, N. J.
Secretary-Treasurer, O. F. Potter, Newark, N. J

INDIANA.
Annual Meeting—Indianapolis, April ———, 1917.
President, A. M. Dolley, Logansport.
Secretary-Treasurer, J. W. Dunbar, New Albany.

IOWA DISTRICT.
Annual Meeting—Des Moines, May 22 and 23, 1917.
President, G. I. Vincent, Des Moines, Ia.
Secretary, T. B. Genay, Des Moines, Ia.

NATURAL GAS.
Annual Meeting—Buffalo, N. Y., May, 1917.
President, J. F. Guffey. Pittsburgh, Pa.
Secretary-Treasurer, T. Clive Jones, Delaware, O.

CANADIAN.
Annual Meeting— ———, August———, 1917.
President, J. P. King, Stratford, Ont.
Secretary-Treasurer, Geo. W. Allen, Toronto Gas Company.

PACIFIC COAST.
Annual Meeting—Santa Cruz, September, 1917.
President, C. B. Babcock, San Francisco, Cal.
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Annual Meeting—Detroit, September, 1917.
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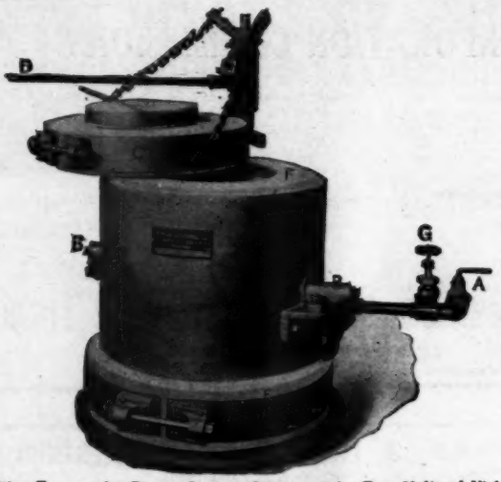

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Pittsburgh Meter Co.
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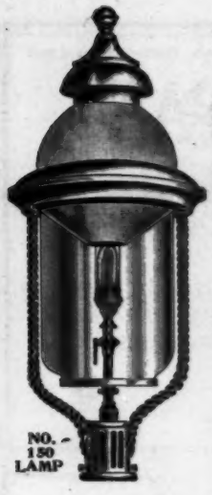

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Day of Week	MOONLIGHT SCHEDULE.		
	Date.	Light.	Extinguish.
Friday	1	10.50 P.M. F.Q.	6.00 A.M.
Saturday	2	12 00	6.00
Sunday	3	1.00 A.M.	6.10
Monday	4	2.10	6.10
Tuesday	5	3.20	6.10
Wednesday	6	4 30	6.10
Thursday	7	5.30	6.10
Friday	8	No L.	No L.
Saturday	9	No L. F.M.	No L.
Sunday	10	No L.	No L.
Monday	11	5.00 P.M.	7.30 P.M.
Tuesday	12	5.00	8.30
Wednesday	13	5.00	9.30
Thursday	14	5 00	10.30
Friday	15	5.00	11.30
Saturday	16	5.00	12.30 A.M.
Sunday	17	5.10 L.Q.	1.30
Monday	18	5.10	2.30
Tuesday	19	5.10	3.40
Wednesday	20	5.10	4.50
Thursday	21	5.10	6.20
Friday	22	5.10	6.20
Saturday	23	5.10	6.20
Sunday	24	5.10 N.M.	6.20
Monday	25	5.10	6.20
Tuesday	26	5.10	6.20
Wednesday	27	5.10	6.20
Thursday	28	5.10	6.20
Friday	29	9.50	6.20
Saturday	30	11.00	6.20
Sunday	31	12.00 F.Q.	6.20

Total Hours Lighting During 1916

	Hrs.	Min.
January	227	50
February	193	20
March	194	30
April	169	10
May	157	10
June	142	10
July	155	50
August	171	50
September	181	50
October	209	10
November	213	20
December	224	50
Total for year	2,241	00

What Advertisers Offer to Readers

See Index Page 20 for Manufacturers' Advertisements of Products Listed here.

Outdoor Lighting Fixtures.
See Street Lamps.
Lamp Posts.

Oxide, Iron.
Henry Bower Chem. Mfg. Co.

Patents. Burnham, R. E.

Paints.
Dixon Crucible Co., Jos.

Photometers.
American Meter Co.

Plants—Complete.
See Engineers—Contracting.

Pipe.
Cast Iron Pipe Publicity Bureau.
Davis & Farnum Mfg. Co.
Donaldson Iron Co.
Sullivan Bros.
Wood & Co., R. D.

Pipe Laying.
New York Lead Wool Co.
Sullivan Bros.
United Lead Co.

Prepayment Meters.
See Meters.

Processes.
See Coal Gas Apparatus.
Water Gas Apparatus.
Hydrogen Gas Apparatus.

Producer Gas Plants.
Gas Machinery Co.
Western Gas Construction Co.
Wood & Co., R. D.

Provers—Meter.
American Meter Co.
Helme & McIlhenny.
Maryland Meter Works.
McDonald & Co., D.
Pittsburgh Meter Co.

Pumps—Drip.
American Meter Co.

Purifiers.
Bartlett-Hayward Co.
Cruse-Kemper Co.
Davis & Farnum Mfg. Co.
Gas Machinery Co.
Isbell-Porter Co.
Stacey Bros. Gas Construction Co.
Stacey Manufacturing Co., The.
United Gas Improvement Co.
Western Gas Construction Co.
Wood & Co., R. D.

Purifying Materials.
Connelly Iron Sponge & Governor Co.
Gas Machinery Co.
Iron Hydroxide Co.
United Gas Improvement Co.

Purifier Trays.
Davis & Farnum Mfg. Co.
Iron Hydroxide Co.
Western Gas Construction Co.

Pyrometers.
Brown Instrument Co.

Ranges—Gas.
Crane Co., Wm. M.

Regulators. See Governors.

Retorts—Horizontal and Inclined.
Didier-March Co.
Gardner, Jr., Co., James.
Gas Machinery Co.
Gautier & Co., J. H.
Improved Equipment Co.
Maurer & Son, H.
Missouri Fire Brick Co.
Parker-Russell Mining & Mfg. Co.
Stacey Bros. Gas Construction Co.

Retorts—Silica & Clay.
Improved Equipment Co.
Russell Engineering Co.

Retorts—Vertical.
Gautier & Co., J. H.
Didier-March Co.
Gas Machinery Co.
Improved Equipment Co.
Parker-Russell Mining & Mfg. Co.

Rubber Goods. See also Bags.

Screens—Coke.
Beaumont Co., R. H.

Services.
Sullivan Bros.
See also Pipe.

Service Cocks.
American Meter Co.
See also Cocks.

Scrubbers.
See Purifiers.

Scrubber Trays.
See Purifier Trays.

Specials. See Pipe.

Steel Construction.
See Iron Work.

Stoking Machinery.
See Charging Machinery.

Stoppers—Gas Main.
Safety Gas Main Stopper Co.

Storage Tanks.
See Holders.

Street Lamps.
Miner, Thos. T. W.
Welsbach Street Lighting Co.

Structural Iron Work.
See Iron Work.

Tar Extractors.
See Coal Gas Apparatus.
Water Gas Apparatus.

Temperature Controlling Device.
American Gas Furnace Co.

Testing—Commercial & Photometrical.
Chemical Service Laboratories.
Electrical Testing Laboratories.

Testing—Electrical & Mechanical.
Electrical Testing Laboratories.

Thermometers.
American Meter Co.
Brown Instrument Co.
Gas Machinery Co.

Tools.
Safety Gas Main Stopper Co.

Tubing.
See Rubber Goods.

Valves.
Bartlett-Hayward Co.
Davis & Farnum Mfg. Co.
Gas Machinery Co.
Isbell-Porter Co.
Ludlow Valve Mfg. Co.
Roots Co., P. H. & F. M.
Stacey Bros. Gas Construction Co.
Stacey Manufacturing Co., The.
Western Gas Construction Co.
Wood & Co., R. D.

Vertical Retorts. See Retorts.

Washers. See Purifiers.

Water Gas Apparatus.
Bartlett-Hayward Co.
Gas Machinery Co.
Stacey Manufacturing Co., The.
United Gas Improvement Co.
Western Gas Construction Co.

Water Gas Linings.
Crane Co., Wm. M.

THE MARYLAND METER

"B" METERS

For Increased Capacity under Slow Speed Operation

ARTIFICIAL AND NATURAL GAS METERS
PREPAYMENT METERS, STATION METERS
METER PROVERS, COMPLAINT METERS, &c.
SPECIAL ATTENTION TO REPAIR WORK

MARYLAND METER WORKS

BALTIMORE—CHICAGO

N. W. REPRESENTATIVE—NORTHWEST GAS EQUIPMENT CO., 1010 SPALDING BUILDING, PORTLAND, ORE.

We are Buyers of

SPENT OXIDE

From Coal Gas Works

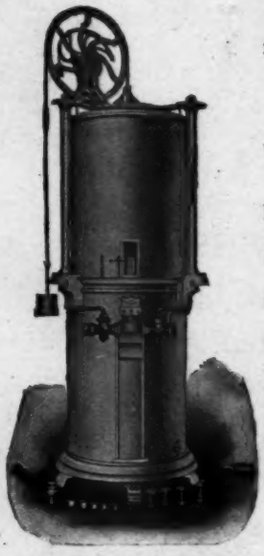
Send us samples and we
will make you an offer

HENRY BOWER CHEMICAL MANUFACTURING CO.
Gray's Ferry Road and 29th Street
PHILADELPHIA, PA.

NEW YORK PHILADELPHIA CHICAGO

THE AMERICAN METER COMPANY

Established 1884



Following are some of the improvements which we have recently made in our

METER PROVERS

Bell inclosed, or surrounded by a jacket, thereby preventing drafts from affecting the accuracy of the machine.

Hollow steel columns in place of wooden posts.

Water thermometer and air thermometer on the same level.

Siphon Gauge placed as near as practicable on the level of the eye of the operator.

Larger cocks and hose, so that meters of greater capacity can be proved on the five-foot machine.

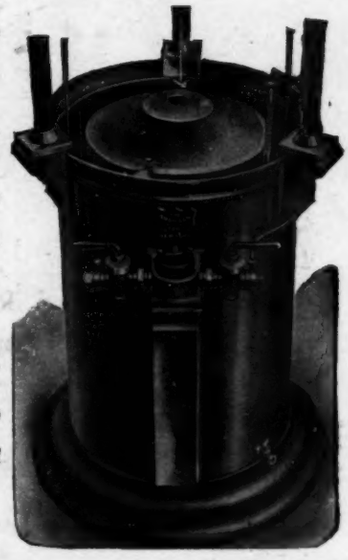
An improved air valve. Wire wound loose.

Annular tank meterially reducing the amount of water, so that the temperature of the same can be more readily changed.

A new adjustable pointer on the scale, so that it can be more easily and accurately read.

Feet with adjustable screws to facilitate the leveling of the prover, also permitting circulation of air underneath.

CATALOGUE SENT ON REQUEST



Our apparatus in the Collective Gas Exhibit at the Panama-Pacific International Exposition was awarded the Grand Prize

NEW YORK, 11TH AVENUE AND 47TH STREET

HELME & McILHENNY

1339-1349 Cherry St., Philadelphia, Pa.

ESTAB. 1848 H & McI

High Grade Meters

GAS METERS

HINMAN DRUM STATION METERS, FOULIS GAS GOVERNORS
PREPAYMENT METERS

REPAIRING AND CONVERTING

PROMPT SHIPMENTS - - - - - CORRESPONDENCE SOLICITED

NATHANIEL TUFTS METER COMPANY

455 COMMERCIAL STREET, BOSTON

Established 1860

MANUFACTURERS OF

GAS METERS

POSITIVE PREPAYMENT GAS METERS THE HINMAN STATION METER DRUM EXPERIMENTAL APPARATUS

A thorough and complete department for METER REPAIRING of All Descriptions

ESTABLISHED 1855.

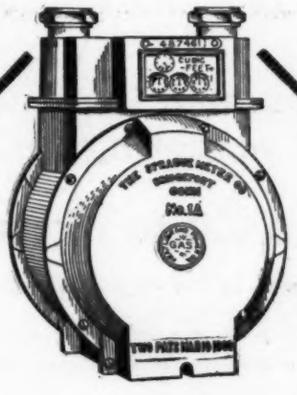
McDONALD METERS

NOTED FOR ACCURACY.

CONSUMERS' METERS, REGULAR AND PREPAYMENT.
STATION METER WORK OF EVERY DESCRIPTION.
METERS REPAIRED. METER PROVERS.
CORRESPONDENCE SOLICITED.

D. McDONALD & CO.,

NEW YORK. ALBANY, N. Y. CHICAGO.



Dependable Accuracy
Lessens Maintenance

With **Sprague Meters** It saves 65 per cent of the upkeep costs. Figure it on the years' installations—then write for proof.

SPRAGUE METER COMPANY

BRIDGEPORT, CONN.

Los Angeles, Cal. Davenport, Ia. San Francisco, Cal.

A Prosperous New Year

can be confidently looked forward to, when your revenue is protected by

IRONCLAD

THE 100% METER

With "Ironclads" on duty you know every cubic foot of gas delivered, whether to minimum or maximum consumers, will be accurately registered. You also know that "Ironclad" Reliability can be depended upon for years. Finally you know that "Ironclad" Service is the most economical—because

"Ironclad" Maintenance is lowest—none excepted

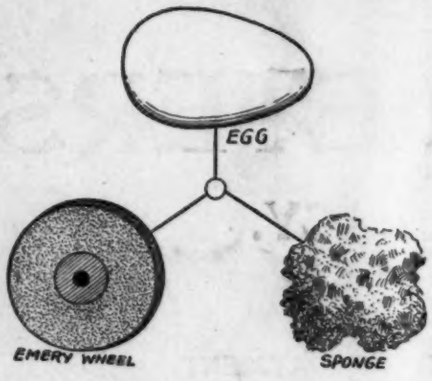
Pittsburgh Meter Company

General Office and Works: East Pittsburgh, Pa.

New York, 149 Broadway. Seattle, 802 Madison St. Kansas City, 6 W. 10th St.
Chicago, 5 South Wabash Ave. Columbia, S. C., 1433 Main St.
Los Angeles, 681 So. Spring St.

Also Manufacturers of Keystone and Eureka Water Meters; Positive and Proportional Gas Meters for Any Pressure, and Meter Provers.

Symbol of Coke



Fragile—

Abrasive—

Absorptive

The aptness of the above illustration is appreciated when domestic coke must be handled, sized, stored and sold. If you disregard the emery wheel, you wear out your handling apparatus, and the egg and sponge end must be respected if satisfied customers are desired.

We Build Our Coke Handling Systems to Respect All Three Sides

Send for Catalog 30, an encyclopedia of all modern methods for handling and screening coke and coal

R. H. BEAUMONT CO.,

1039 DREXEL BLDG. **PHILADELPHIA, PA.**

No. 1682—CONE FIXTURE
There is also a plainer design, No. 1680.
See page 12 of Welsbach Special List of Lighting Appliances for Gas Companies—or write nearest sales office.

Interior Commercial Lighting de Luxe

Welsbach Cone Fixtures

Newest Examples of the Superiority of Gas

THESE fixtures meet the requirements of the demand for handsome gas lighting units for offices and stores.

They give both a well diffused and reflected light —the semi-indirect illumination now so popular.

The cone reflects the light, diverts and dissipates the heated air currents, preventing discoloration.

They are simple in construction, practical, low in maintenance costs and easy to care for.

Made in both 3 and 4-mantle units with chain suspended decorated bowls. Ornamentation in solid cast metal making a rich appearance.

WELSBACH COMPANY

FACTORIES

GLOUCESTER **NEW JERSEY**